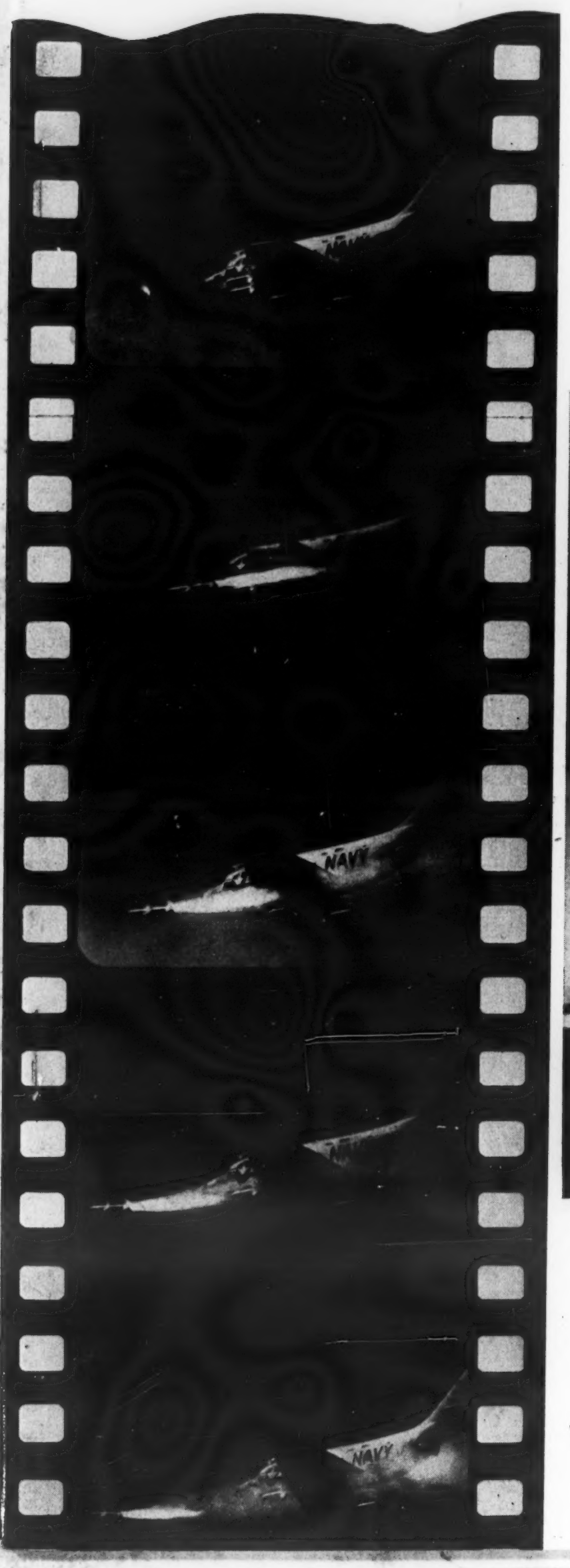
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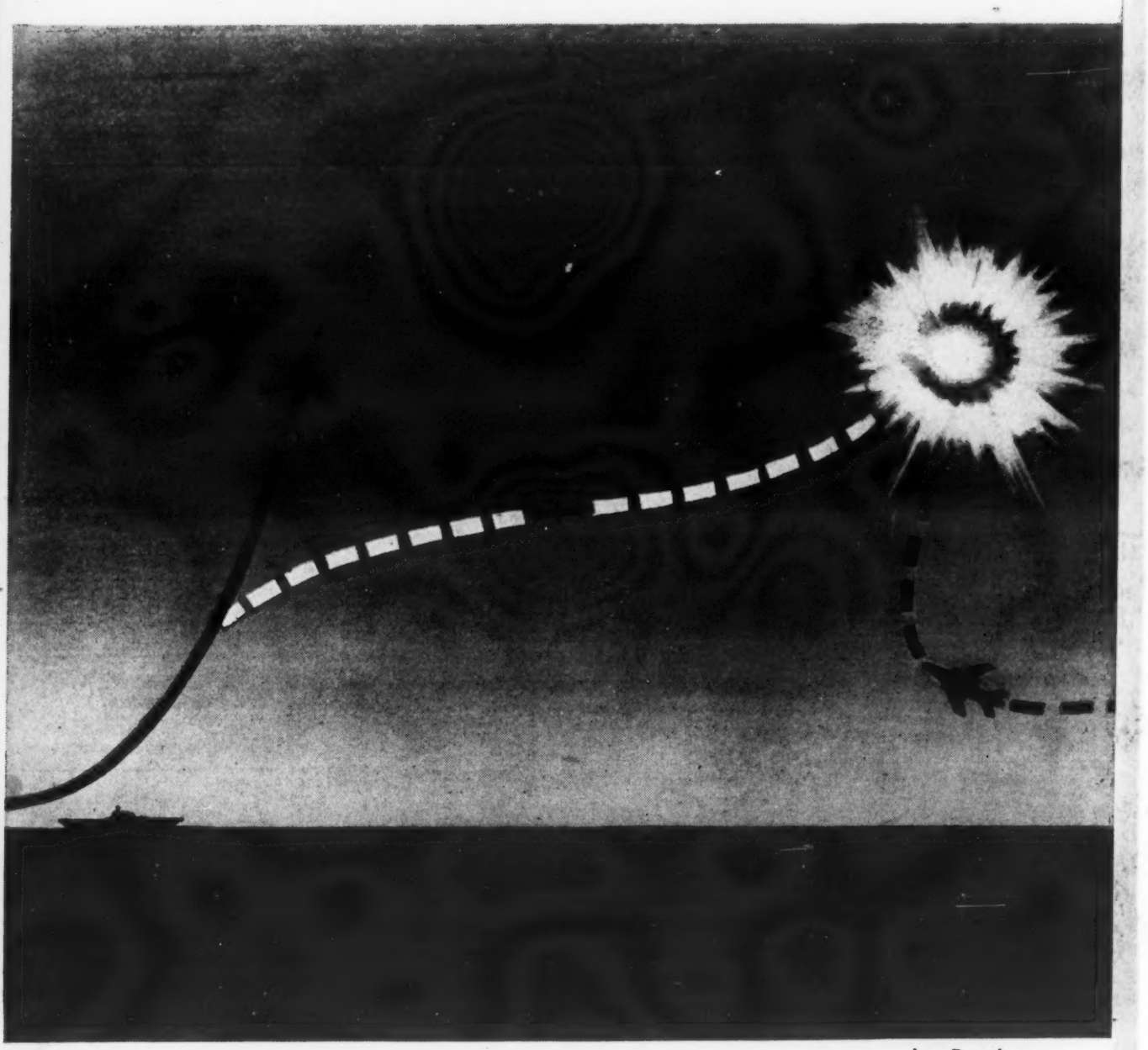
Communications—Electronics—Photography • On Land Sea and Air

February 1959



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2N500			45% at 200 mc	Oscillator to 350 mc
2N501	Ultra high-speed switch typical t_r = 9 mμsec; (18 max.); t_s = 9 mμsec; (12 max.); t_f = 7 mμsec; (10 max.) in circuit with current gain of 10 and voltage turnoff.			
2N502†	800 mc	11 db at 200 mc		amplifier to 250 mc
2N503†	420 mc	12.5 db at 100 mc		amplifier to 175 mc
2N504	50 mc (min.)	46 db at 455		high gain IF amplifier
2N588	250 mc	14 db at 50 mc		Oscillator and amplifier to 80 mc

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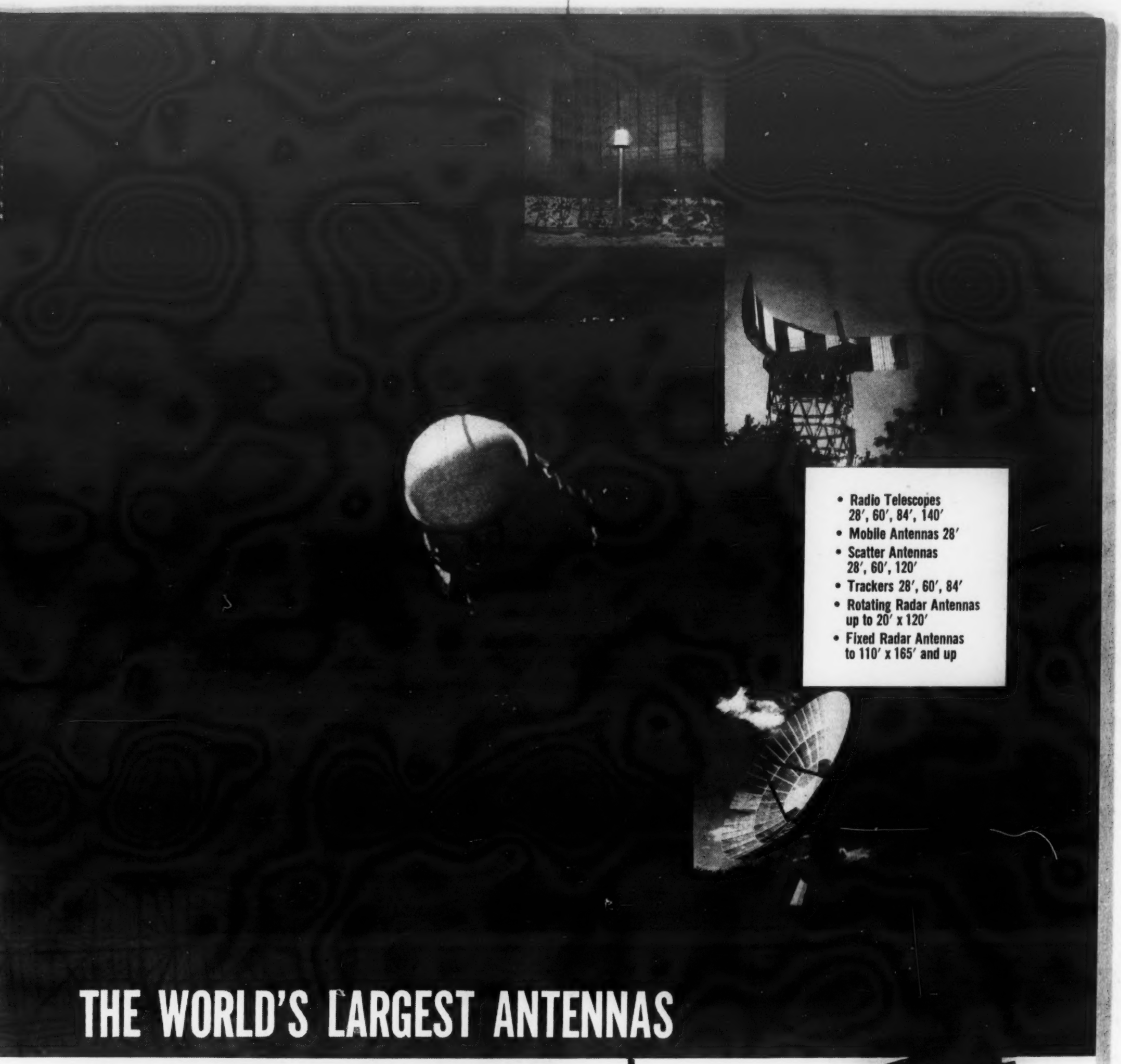
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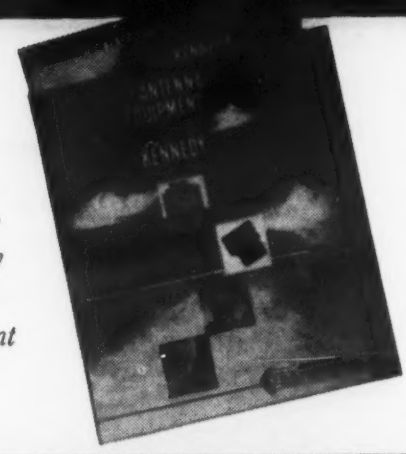


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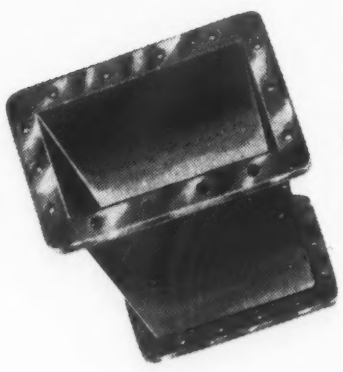
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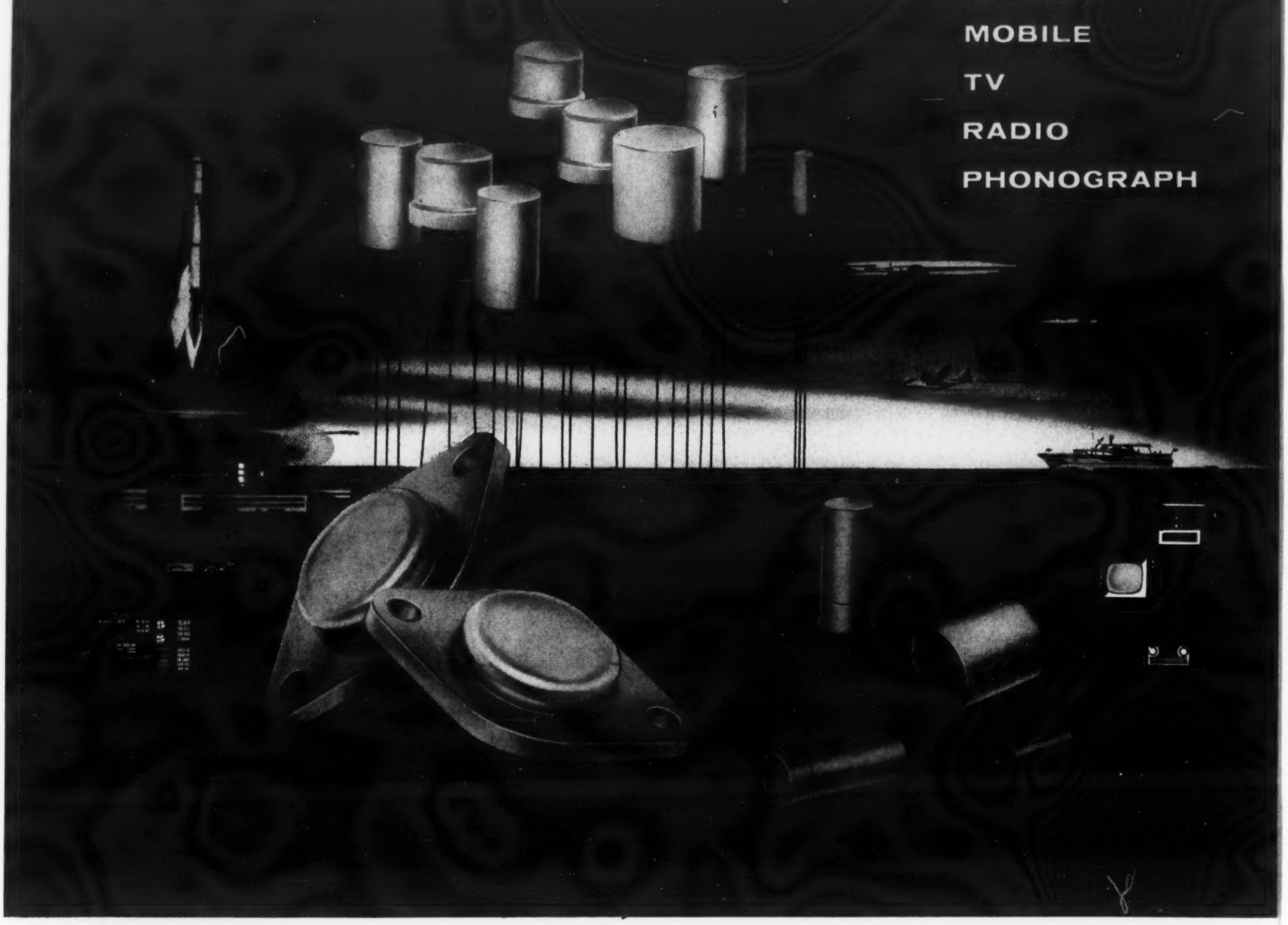
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BPA

SIGNAL

Communications-Electronics-Photography

Journal of the Armed Forces Communications and Electronics Association

VOLUME XIII FEBRUARY 1959 NUMBER 6

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Announcement

SIGNAL *will feature a special March issue on components. The role of components in electronics and communications systems makes the difference between operational success or failure. You will want to read what the U. S. Army Signal Research and Development Laboratories have to say. See pages 30 and 31 of this issue for a synopsis. Be sure to order your extra copies now.*

Authors are entirely responsible for opinions expressed in articles appearing in AFCEA publications, and these opinions are not to be construed as official or reflecting the views of the Armed Forces Communications and Electronics Association.

ation and how we can adequately circumvent its possibly harmful effects.

A second purely scientific interest in space travel is in the field of astronomy. Astronomy is perhaps the oldest of the sciences and it is amazing the amount of information that has been accumulated concerning the planets and the stars, many of which are millions and millions of miles away. In addition to the limitation imposed by the mere smallness and remoteness of our observation platform, the earth, there are other limitations. So far, astronomers have been studying the universe by radiations from only a small crack in the entire electro-magnetic spectrum. The most interesting radiations from most astronomical bodies lie in the ultraviolet, a region that is completely absorbed by the atmosphere and so never reaches the surface of the earth.

Not only does the atmosphere absorb a large amount of the incident radiation from astronomical bodies but also the quality of the visual and photographic observations that can be made is seriously degraded by irregularities in the atmosphere. The presence of the atmosphere limits optical resolution to about one-quarter of a second of arc, and these conditions occur only under ideal circumstances a few times a year. The atmosphere degrades the recognition of detail in any astronomical observation by a factor of the order of ten. If we could, for example, place the two-hundred-inch telescope on a stable platform such as the moon, the quality of the observations that could be made and the detailed information that could be gathered without the interfering effects of the earth's atmosphere would give us a much more than ten-fold increase in our knowledge of the universe.

A third example of the scientific challenge of space is presented by Mr. Einstein's much talked about theory of relativity. As a result of his precious theory of the relationship between matter and energy, we have the whole field of atomic energy, which involves the conversion of matter into energy. A partially verified prediction of the theory of relativity is a relationship between light and gravity.

However, one area in which we have practically no experimental verification is the relationship of time and motion. The theory of relativity predicts that as the velocity of a body approaches that of light, its mass or inertia increases and time for the body is slowed down. The first has been thoroughly verified in the physics laboratory in the dealing with sub-atomic particles at high velocity. We have, however, no really valid direct verification of the slowing down of time.

One interesting aspect of this relativity of time concerns the possibility of man's traveling to the far distant planets and stars. We should realize that a trip to the moon would take only a few days, a trip to Mars would take a matter of two or three years, using presently available rocket power and velocity. However, even the nearest star, in the constellation Centauri, is so far away that it takes light four years to reach us at a velocity of 186,000 miles per second. Other stars are up to thousands and millions of light-years away. Thus, even assuming that we could develop a fuel and rocket system that would enable us to achieve or even approach the velocity of light, it is obviously impossible for any given individual to reach these more distant stars and return to earth within our normal concept of time.

However, one interpretation of the time-velocity relationship of the Einstein theory is that an individual aboard such a space ship, traveling with a velocity approaching that of light, would age less rapidly than would those who remained on the surface of the earth. For such a space ship to make a round trip to the center of our galaxy would require a total time as seen on the surface of the earth of 60,000 years, whereas the time as seen aboard the space ship would total only 42 years. This would mean it would be quite feasible from the time point of view for individual men to make this round trip. They would, of course, find that some marked changes had taken place on the surface of the earth during their absence.

The third major element of The Challenge of Space is the challenge of real benefit to the human race. As great as may be the challenge to man's exploratory curiosity and the even greater challenge to his scientific curiosity, these are not enough to accomplish such a major undertaking as the exploration of outer space. Basically, men who are imbued with the curiosity of the explorer and the deeper curiosity of the scientist are not the men who have the necessary funds to finance such major undertakings. Although it was primarily the spirit of adventure that drove such men as Columbus, Vasco de Gama, Hudson and Cortez as individuals, it was really the possible commercial return from their explorations which rendered them practicable—that prompted Isabella to hock the family jewels.

The actual return from such trips was often from a direction not even remotely contemplated. It is never possible to predict the real commercial value of geographic exploration or scientific research. Scientific research is a self-generating, a self-multiplying phenomenon. Each new discovery in fundamental or basic science opens up new possibilities for the applied scientists and engineers to interpret the results and devise ways and means for utilizing them in providing new products, new types of consumer goods, new elements in our standard of living.

Practically all of our present high standard of living is a direct result of scientific research and technological development of the past 100 years. Our automobiles, our aircraft, our electrical equipment, even the clothes we wear, the food that we eat, the glasses we use, all are individually the direct technological outgrowth of scientific research carried on merely because of man's innate curiosity.

Although we can never hope to predict in any detail the real benefit that may derive from any scientific or geographical exploration, we can, even at this early stage, see three probable results of space exploration that will have a most significant impact on our economic structure and our standard of living. The first of these is in the area of communication. One of the most serious limitations of present radio and television systems is the fact that high-frequency transmissions can go only in straight lines and so will not effectively bend around the curvature of the earth or over mountains.

It is possible by the proper positioning of a satellite in an orbit to have it in essence remain stationary, relative to the surface of the earth. The feasibility of this is indicated by the fact that for the satellites that are only a few hundred miles above the surface of the earth, the period of revolution is about an hour and a half to two hours, whereas for a satellite at the distance of the moon, the orbital period is 28 days. Obviously, between these two, there is an altitude at which the period will be 24 hours so that the satellite will revolve around the earth at the same speed that the earth rotates on its axis. This altitude is 22,300 miles.

(Editor's Note: "Project Score" having successfully established the communications possibilities with rotating satellites, now points the way for a communications breakthrough at the 22,300 mile altitude and offers new challenges.)

Such a satellite would in effect have a fixed position relative to the surface of the earth. It could thus be utilized as a more or less fixed relay station for high frequency radio and television communication. Two or three stations would enable us to cover essentially the whole surface of the earth with broadcasts from a single earthbound station.

Another one of our major problems is our weather. Every year there are millions of dollars of damage done by storms that we could not adequately predict or in any sense control. The use of television techniques in a satellite to observe the weather pattern over the entire surface of the globe within a very short period of time, should lead to a better understanding of the causes of our weather conditions and hence to a better prediction of weather.

A third area of potential economic application of satellites themselves is an aid to navigation. It is presently possible with standard navigational equipment to locate by observation of the stars the position of a ship at sea to within about one mile. By the same

(*Continued on page* 18)



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EXTRAMURAL SCIENCE PROGRAMS OF THE DEFENSE DEPARTMENT

by GEORGE D. LUKES • Executive Secretary • Defense Science Board
Office of the Assistant Secretary of Defense (Research and Engineering)



WE IN DEFENSE find a symposium* of this nature an excellent opportunity to get across to the scientific community at large the nature and scope of our scientific research activities and how our extramural activities contribute to the achievement of Defense objectives. Within this framework I shall weave some of the more significant aspects of our policy on basic research in the hope of furthering understanding.

It is important to provide, first, a backdrop of the total dollar effort of Department of Defense scientific research and development. The first chart shows (on page 9) the DOD obligations for fiscal year 1959 in relation to those of the other Federal Government agencies. Something like 62% of all Federal funds devoted to research and development represents the Defense Department's share of the Federal effort. The second chart displays the approximate distribution of these funds in terms of the three major performance components: government laboratories, industrial contractors, and university and other nonprofit institutions. You will note that industry performs about 60% of the total effort supported from the research and development appropriations of the Department of Defense, universities and other nonprofit institutions conduct about 9%, and government laboratories perform the balance of 31%. Of funds for in-house performance, approximately 14% is for research and development *per se* conducted internally by government scientists and engineers, 13% is for test and evaluation, and 4% is for contract monitoring.

I should now hasten to add an additional source of funds is available for support of scientific and engineering activities of the Department of Defense, primarily the latter. These, in appropriation language, are principally the Procurement and Production funds, of which something like $3.2 billion in FY 1959 go to the support of development, test and evaluation of new weapons of the distinctively hardware variety — the B-58 and the IRBM and ICBM programs are good examples. The charts you have seen and the figures presented do not include the funds from this source; within the theme of this symposium — extramural science — their ommission is of little consequence, however.

Now let us discuss the scientific research activity of the Defense effort. The third chart displays the character distribution of the Defense research and development program. Of our FY 1959 research and development programs, 15%, or $391 million, is devoted to research; and of this, $109.6 million is for basic research. The balance, 85% of the total program, is for development. We estimate that almost two-thirds of the $391 million of research funds supports extramural activities, and at least 70% of the $109.6 million basic research funds is devoted to extramural support of basic research.

The science programs of the Department of Defense include activities in the physical and engineering sciences, in the life sciences, in psychology and the social sciences, and operations research.

About 80% of the funds devoted to scientific research support activities in the physical and engineering sciences; this amounts to about $313 million in the FY-1959 Defense program. Within this broad category the typical fields of endeavor and the program objectives are as follows:

In *physics* the objective is the advancement, through systematic and exploratory research, of those selected aspects of pure and applied physics which contribute to an increase in military capability. The present program, totalling about $33 million in extramural effort, includes solid-state physics, extreme-temperature physics, statistical physics, physics of atoms and molecules, nuclear physics, physical acoustics, upper-air physics, electron physics, optics, magnetism, instrumentation for physical measurements and electromagnetic radiation.

In *chemistry* the objective of the program may be divided into two parts: (1) a balanced effort of selected fundamental research which serves as a foundation for the varying needs of the military and (2) specific applied projects aimed at satisfying short-term defense needs. The present program includes research support in relevant areas of analytical, inorganic, organic, physical, polymer and radiation chemistry. The extramural support runs about $31 million yearly.

In *mathematics* the objective is the systematic advancement of this science, closely geared to the objectives of the other scientific programs, and in response to expanding needs for direct qualitative information about the design and operations of weapons and weapons systems. The present program includes algebra, analysis, geometry, topology, probability, statistics, logistics, communications and computers. Extramural support runs about $5 million yearly.

With respect to those fields of endeavor that are more characteristically the engineering sciences, the scope of the programs and the broad objectives are as follows:

Mechanics: The objective of the research program in mechanics is the systematic advancement of engineering knowledge and principles bearing directly upon design criteria for the

*Presented at the 125th Meeting of the American Association for the Advancement of Science, Washington, D. C.

development of new weapons systems and components. Studies on the following are included in the present program: the dynamics of gases, liquids and solids; aerodynamic problems; problems involving structural design, strength of solids, hydromechanics, propulsion, heat and mass transfer, soil mechanics; and problems involving the development and synthesis of mechanisms. Extramural support runs about $25 million yearly.

Materials: The objective of the research program is the systematic advancement of knowledge on the fundamental properties and behavior of materials to provide the best possible selection for designers and fabricators of military weapons and equipments. The present program includes studies on metals, minerals, ceramics, elastomers, adhesives, transparent materials, organic structural materials, fibers and fibrous materials, insulating materials, and dielectric and magnetic materials. Extramural support runs about $27 million yearly.

Combustion: The objective of the research program in the field of combustion is to gain an increased understanding of the total process of transforming the chemical energy of reactants into thermal and kinetic energy of reaction products, so the design of military propulsion devices can be put on an increasingly rational basis. The present program includes investigations of basic phenomena in selected areas of physics, chemistry, fluid mechanics, thermochemistry, and thermodynamics; and also fundamental investigations of processes that are interrelated combinations of these phenomena. Extramural support runs about $6 million yearly.

Electronics: The objective of the research program in electronics is to ensure maximum extension and acceleration of all of our senses for military purposes. The present program includes acoustics and underwater sound; antenna theory, electromagnetic propagation and reflection; communications, data handling, and information theory; electronic instrumentation and standards; electronic countermeasures and counter-countermeasures; IFF theory; infrared; navigation; radar; electronic tubes, parts and semiconductors, and electron and ion plasma. Extramural support runs about $43 million yearly.

In the *geophysical sciences* the objective is the advancement through systematic and exploratory research of those selected aspects which will increase the capability of the military to utilize, predict, and control the natural environment. Included in the present program are meteorology, climatology, oceanography, marine geology, geochemistry, cartography, geodesy, geography, astronomy, astrophysics, magnetism and gravity studies. Extramural support runs about $19 million yearly.

Turning now to the broad category of life sciences, the DOD supports major programs in the medical sciences and in biology. The scope and the objectives are:

In the *medical sciences*, to provide support of the mission of military medicine by studies in—

(a) Preventive medicine: research on methods of physical examination and health surveillance, promotion of physical fitness, preventive dentistry; nutrition, environmental physiology and pathology, disease and injury prevention, toxicology; protection against radiation and blast, the effects of chemical and biological agents, with methods of casualty prevention; industrial and public health studies.

(b) Studies relating to the medical problems of aviation, astronautics, submarine and diving medicine, man in relation to the machines of war in all media, terrain and climates; and survival techniques.

(c) Improved methods of medical, surgical, dental and psychiatric care and rehabilitation of the sick and injured.

The medical sciences program runs about $24 million yearly, of which about $15 million is the extramural effort.

In the *biological sciences* the objective is the systematic development of this field in areas of military interest. The present program includes hydrobiology, biogeography, ecology, the biomechanism of complex data reception and control in living systems, bacterial fungal, viral genetics and nutrition, the ecology of disease vectors, the mechanism of infection, and the survival of microorganisms. Extramural support runs about $7 million yearly.

As to the *psychological and social sciences*, the support level is about $21 million, of which $15 million is the extramural effort. Program content and the objectives are: the advancement through systematic and exploratory research of those selected aspects of pure and applied psychological and social sciences which contribute to an increase in the military capability. The present program includes studies leading to new concepts, techniques, devices, and principles applicable to the solution of military problems, including military manpower needs and the availability,

(*Continued on page* 12)

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FEDERAL GOVERNMENT RESEARCH AND DEVELOPMENT OBLIGATIONS

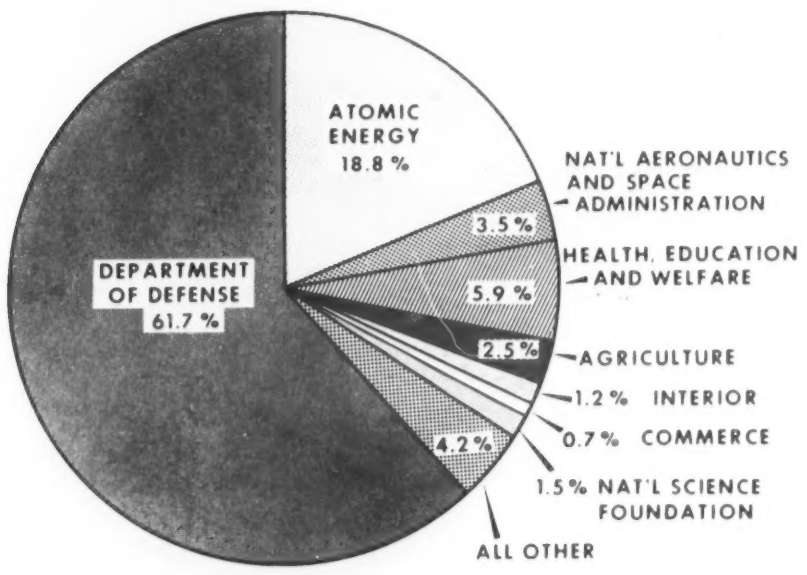


CHART 1

WHERE DEFENSE RESEARCH AND DEVELOPMENT IS PERFORMED

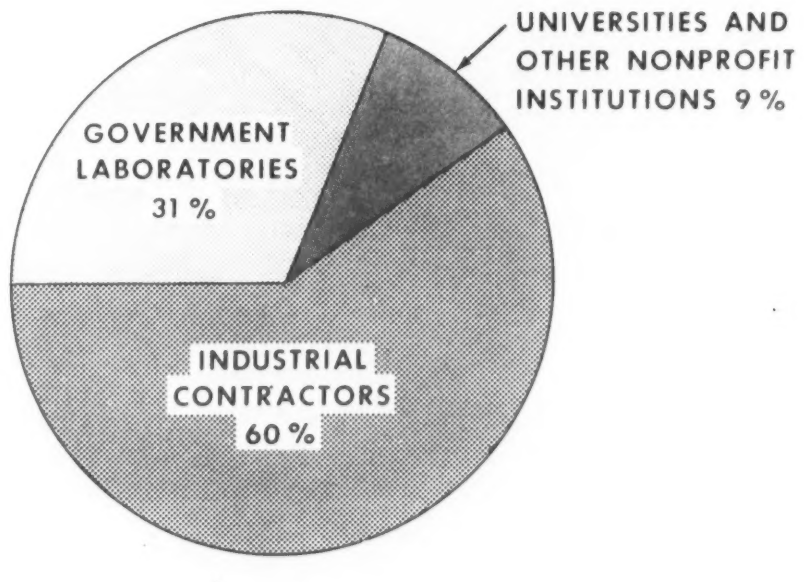


CHART 2

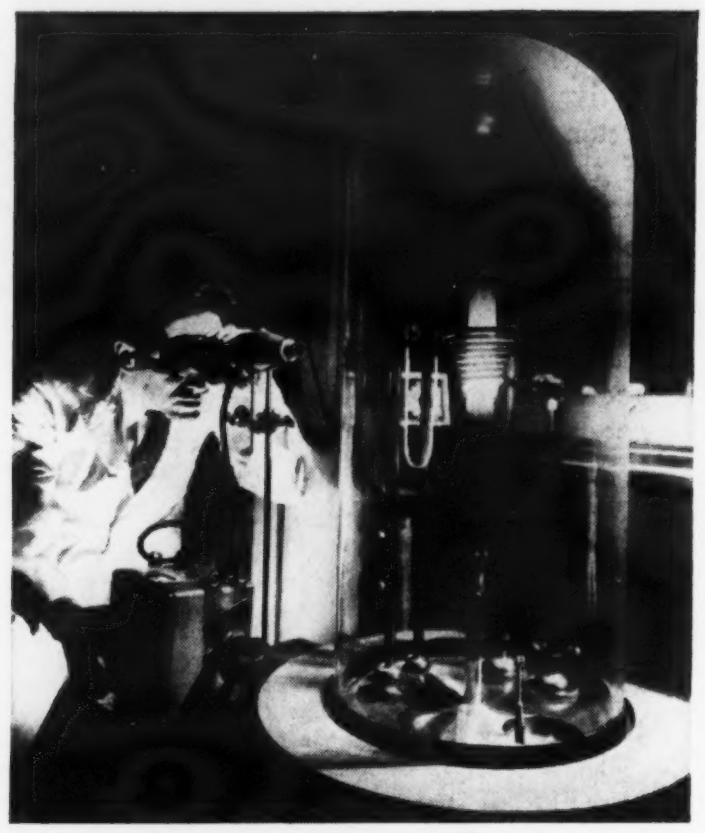
CAPABILITIES FOR DEFENSE

Westinghouse is spending $185 million for research and development in 1959

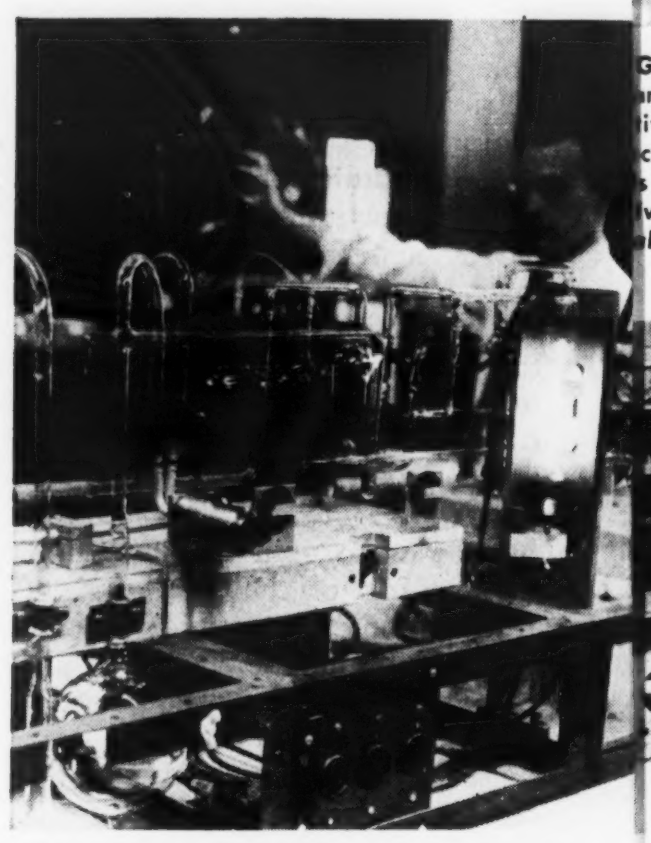
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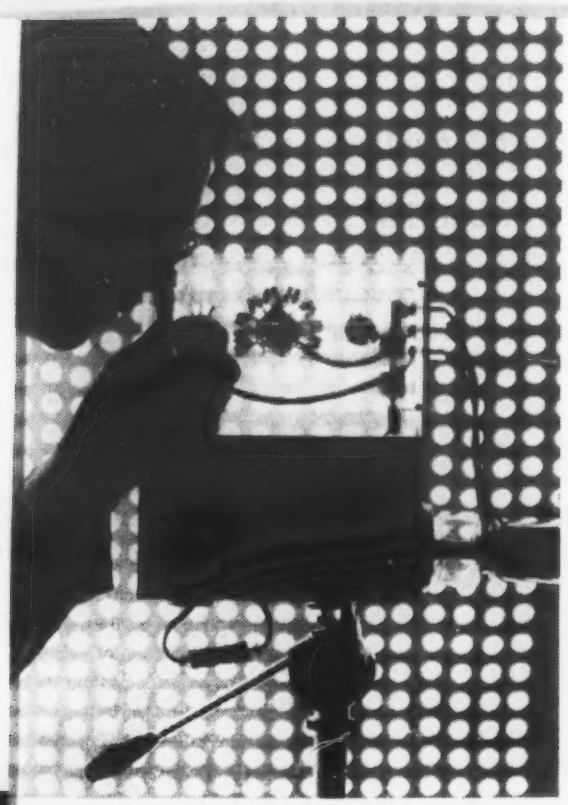
HIGH-VACUUM RESEARCH. Extensive high-vacuum research conducted since 1947. Current areas of investigation include electrical and chemical pumping in ultra high-vacuum range and component development for large high speed pumping systems. Results being applied in advanced electronic device development. ***Air Arm Division and Research Laboratories***



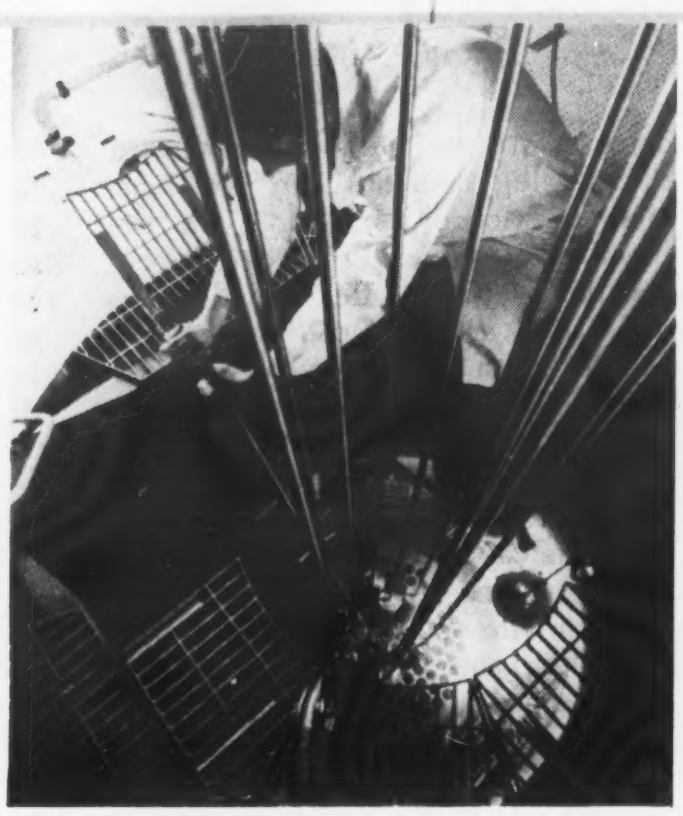
UNDERWATER SONICS. Current Westinghouse projects being conducted in laboratories and at sea are investigating various types of "scatterers" and their effect on the underwater transmission of sound. Also under development: acoustical torpedo controls and an acoustical mine identification system. ***Ordnance Department and Research Laboratories***



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GHT AMPLIFICATION, through electron bom-rdment induced conductivity. Extremely sen-ive. Principle especially useful for satellite connaissance devices. Efficient working mod-s have been developed. *Electronic Tube ivision, Astronautics Institute and Research boratories*



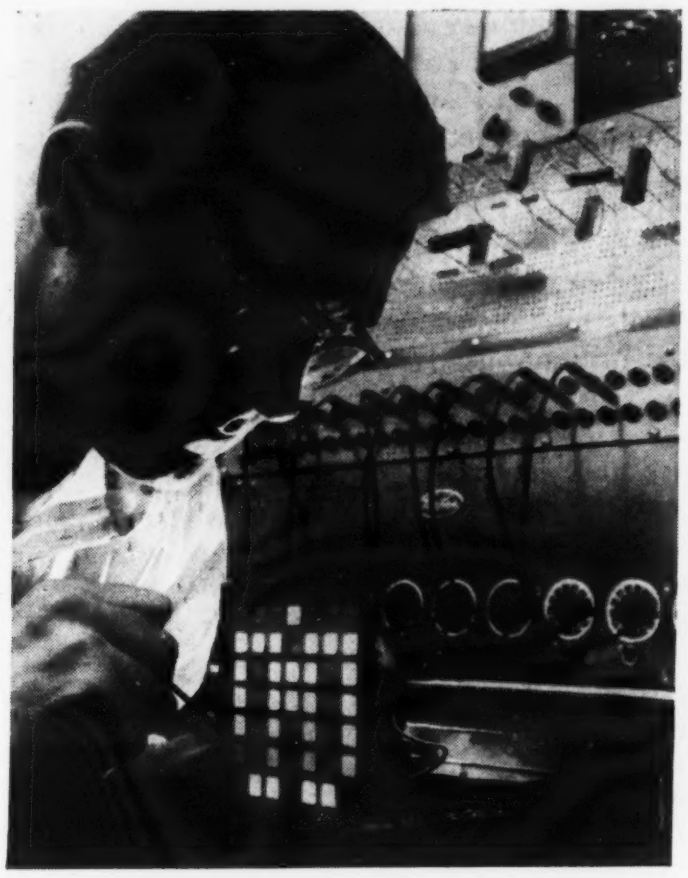
NUCLEAR RESEARCH. At the Westinghouse Testing Reactor, engineers are preparing high intensity radiation tests on a wide range of materials to determine their structural, chemical, and nuclear stability. This is a necessary prelude to using these materials in certain atomic power applications now under development. *Atomic Power Department*



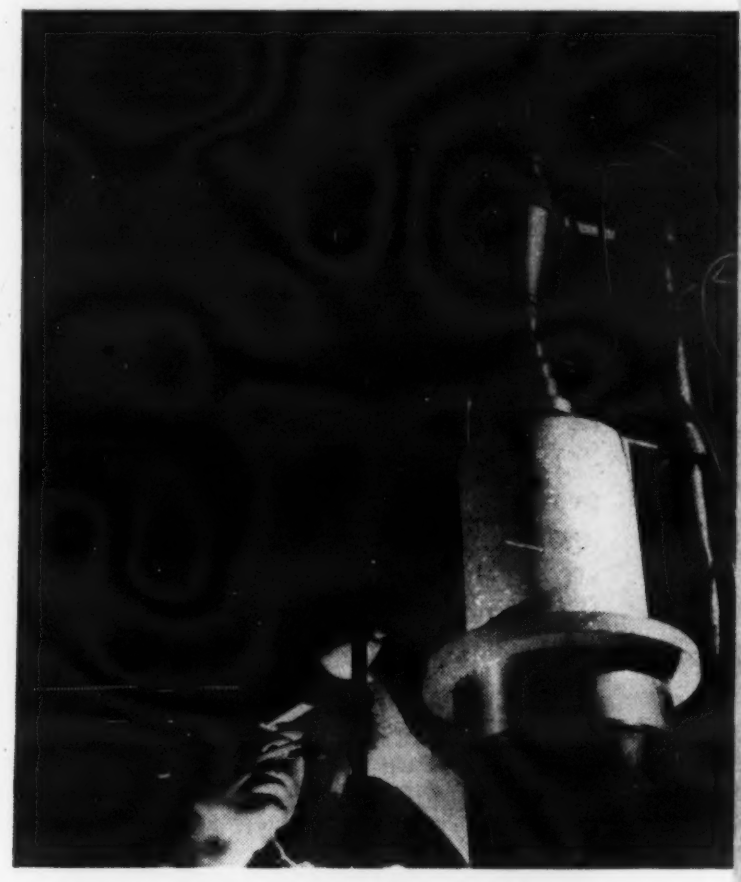
INFRARED research projects include: *thermal imaging* — working models in advanced development; *ultrasensitive doped crystal detectors* — advanced test models; *photo-electric magnetic detection* — working model. *Air Arm Division, Semi-Conductor Department, Materials Engineering Departments, and Research Laboratories*



ULSE-DOPPLER RADAR is in advanced devel-opment in three major areas of application at Westinghouse. Research is continuing to open p new potentials. Westinghouse is the cknowledged leader in this field. *Air Arm ivision*



NEW DATA DISPLAY DEVICES. Electroluminescent cells, individually controlled, form flat picture. Model has oversize cells for demonstration; latest techniques produce cells only 1/16" across. Similar tote board display, capable of high-speed read-out of digital inputs, in production. Both devices can be erased instantly or retained and studied for long periods. *Electronics Division, Rayescent Lamp Department and Research Laboratories*



THERMOELECTRICITY. Westinghouse recently developed the first efficient material to produce electricity directly from heat at high temperatures (1100° C). In addition, other thermoelectric material under development can be used for cooling purposes, including very light-weight applications. Forty Westinghouse scientists now on this project. *Materials Engineering Department and Research Laboratories*



LOW-NOISE MICROWAVE AMPLIFICATION. Westinghouse scientists have developed various low-noise solid-state amplifying devices, both MASER and non-linear reactance types. Progress in recent years was speeded by prior years of research in low-temperature and solid-state physics. *Air Arm Division and Research Laboratories*

For information on these and other research projects, write to Mr. E. W. Locke, Director, Customer Relations, Westinghouse Defense Products Group, 1000 Connecticut Avenue, N.W., Washington 6, D. C.

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Extramural Science Programs

(*Continued from page 9*)

selection, classification, assignment and proficiency measurement of personnel; education; training and training devices; motivation; morale; leadership; human organization; human engineering; psychological and unconventional warfare; intelligence operations; civil affairs and military government.

Finally, coming to *operations research* as a field of scientific activity in its own right, the objective is to provide quantitative bases for executive decisions on military and related scientific matters. The present program includes contracts totalling about $28 million in support of work with RAND, the Operations Research Office, the Operations Evaluation Group, the Combat Operations Reciples applicable to the solution of military problems, including military manpower needs and the availability, search Group, the Institute for Defense Analyses, the Human Resources Research Office, the Naval Warfare Analysis Group, and the Naval Warfare Research Center.

In total, these scientific research programs contain an FY-1959 Defense effort amounting to about $391 million, providing about $137 million to the conduct of intramural effort and $254 million to the support of extramural science activities.

Let us turn now to objectives stated even more broadly. About a year ago, Secretary McElroy issued a strong policy directive setting forth the principles governing the support of a Department-wide basic research program, conceived and anchored in imaginative long-term planning and long-term funding. This policy recognizes that "the needs of national defense are uniquely characterized by pressing demands for new facts and knowledge very close to the frontiers of science" in order to protect the security of the United States and its vast Defense investment against both technological surprise and obsolescence. It emphasizes also that the costs of basic research are small in proportion to the potential military strength to which basic research is capable of contributing and that "sustained support of basic research offers one of the most promising opportunities for effecting long-range economies in other aspects of the military program."

Specifically, the directive states:

"A. It is the policy of the Department of Defense:

"1. To support a broad and continuing basic research program to assure the flow of the fundamental knowledge needed by the military departments as prime users of scientific facts and to evolve novel weapons of war; and

"2. To maintain, through such a broad support program, an effective contact between the military departments and the scientists of the country so that the military departments are continuously and growingly aware of new scientific developments and the scientists are aware of the military needs.

"B. It is further the policy of the Department of Defense to coordinate its basic research program with the National Science Foundation and to encourage the support of sound basic research programs by government and private agencies, recognizing that these programs are essential to the full development, utilization and growth of the nation's scientific resources and, hence, to national defense."

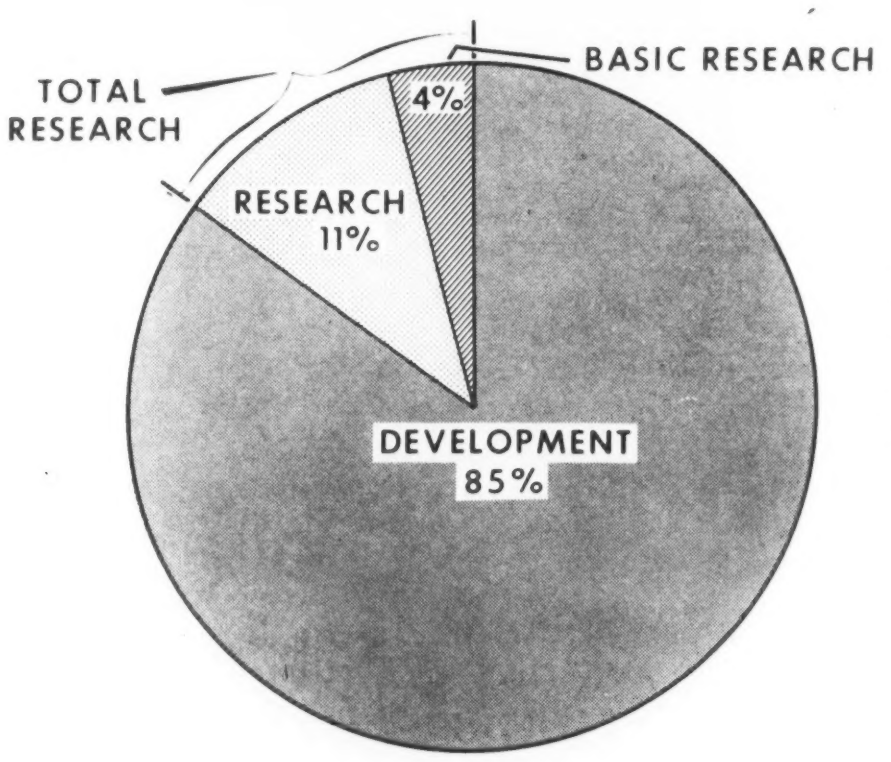


Chart 3: Character of Defense Research and Development Program for FY 1959

Within the guidance of this policy, the Department of Defense substantially increased FY 1958 funding for some research programs judged critical for the improvement of military weaponry. The increased funding for each field was: $31.6 million for the physical, medical and geophysical sciences, $10 million for materials research and $12.5 million for the vital areas of electron tubes and electronic parts. $30 million of these funds went to the support of basic and supporting research programs at academic institutions. The main effect was to restore research to the level from which it had sagged over the past several years owing to inflation and the increased costs of modern instrumentation. In addition to the above funds, $12 million was made available to the Army and Air Force in June of last year for the explicit purpose of financing certain contractual research programs for periods longer than the annual program increment or to provide for program longevity.

The last session of Congress saw the passage of Public Law 85-934, an act to authorize the expenditure of funds through grants for the support of scientific research. Heretofore the Department of Defense has been limited to the use of a research contract in engaging the services of an educational or other nonprofit organization. The Grants Act provides the authority to make grants to such institutions or organizations for the support of basic scientific research, where such action is deemed to be in furtherance of the objectives of the agency. It also grants discretionary authority to vest title of research equipment in the organization carrying out such research. Increased flexibility will result accordingly from this authority in Defense support of basic scientific research. A directive is presently being drafted in the Department of Defense to establish a uniform policy among all military agencies in the awarding and administration of research grants and the transfer of title to research equipment acquired under such grants.

This, I believe, covers the highlights of Defense science programs and our broad objectives in their support, the program content and technical objectives of our scientific effort in some discrete fields, and certain aspects of Defense policies designed to be constructive, forward-looking, and to lend stimulation and sustenance to science from the Defense end of the Federal Government.

THE ROLE OF THE MISSILE INDUSTRY IN ASTRONAUTICS

by L. EUGENE ROOT, Vice President and General Manager, Missile Systems Division, Lockheed Missiles

WHEN IT WAS SUGGESTED to me that I present my views on the role which the missile industry is playing in astronautics, I suspected that it was an open invitation to make the classical discourse on the subject. You all know how it goes—the development of astronautics carried along on the back of the guided missile. It makes a good story—the German pioneers of the "Interplanetary Society" struggling along with their small-scale experiments, until they were picked up by the German Defense Ministry and deposited in Peenemunde with the vast resources that perfected the V2 missile, but still dreaming of the conquest of space. Then the sequel, after World War II, when the national and technical resources of the U. S. were brought into the further development of the ballistic missile; this provided the powerful engines, the guidance techniques and hypersonic know-how with which the exploration of space could finally be *started*. There is a third chapter which tells how Russian ballistic missile development followed the same course, arrived at an orbiting capability at about the same time, and turned the pioneering exploration of space into a kind of "Gold Rush," 1957 version.

You have probably heard this approach before, and you will undoubtedly hear it many times again. I am not going to discuss it any further; instead, I want to examine the part which "the industry" should play in the next few years, now that astronautics has become an important technology in its own right. Evidently, we are not past the time when astronautics made progress only by the fortuitous coincidence with ballistic missile development; in fact, there are many of us at Lockheed, and undoubtedly others, who anticipate now a divergence between the future paths of development of the ballistic missile and the space vehicle.

In particular, the differences arise mainly from the *small size of the earth and the large size of the universe*. On the earth, for example, there are no radio communications circuits which are expected to work over distances longer than about 5000 miles (San Francisco to Manila —Honolulu to Italy); a radio communications circuit even to a moon vehicle would involve distances 50 times greater. (Ceres is 4 light years away.) Thus, taking into account the inverse-square law, the difficulty of radio communication is increased by about three orders of magnitude. For planetary distances, the problems concerned become even more impressive. For journeys outside the solar system — supposing we knew how to make them—we should find ourselves in a totally new regime.

Again, considering the minuteness of the earth and the vastness of outer space, we find that the requirements of military missile performance are strictly limited by the short range of the longest significant mission. A military missile is required only to propel itself from one point of the surface of the earth to another; even taking the long way around, this involves a 20,000-mile journey all of which is accomplished in a strong gravitational field and much of which must be done in a dense atmosphere. Under these circumstances, the requirements for propulsive devices involve high thrust for short periods of time. For the long missions of space travel, engines of very low thrust but high specific impulse may well turn out to be most useful. There is no presently known, economically feasible way to design and develop such engines, even though military use can well be visualized.

The same general remarks apply to other important fields of technology—to guidance, to navigation, and elsewhere. They apply to the developments necessary to enable men to live in the new and largely unknown environment of space outside the protective envelope of the atmospheric ocean at whose bottom we live.

I propose to examine briefly the part which our industrial teams should play in the next few years, while these changes are going on.

During these years, astronautics will be almost certainly in the exploratory stage. We shall be learning how to live, how to adapt ourselves, our instruments, our habits and customs to the new environment. When we talk of the "exploration of space" we imply exactly the same kind of adventure that has stimulated all exploration; it is of course this challenge which explains the tremendous current public interest in astro-



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nautics—the challenge of moving about the solar system with perception. Ever since the disappearance of our western frontier, we have looked for some substitute for the old adage "Go west, young man." And here it is, in the conquest of space, an unprecedented technical challenge with overtones of international rivalry. The small boy whom we might meet on the playground in these days, with a space helmet on his head and a six-gun at his hip, is perhaps not too incongruous. He represents the present space explorer: over-all a westerner, but an "astronaut" from the neck up.

Even at ground level, the pattern of exploration has been changing greatly during the last few years. The individual explorer, who vanished for ten years into the wilderness and came back with fabulous tales, has now gone forever. Consider our recent attempts upon the last remaining frontiers on earth. For example, look at the present South Pole exploration involving the military scientific programs, private industry and individual specialists; it is now a concerted team effort rather than a matter of individual and personal accomplishment. With respect to the North Pole, the recent below-the-ice exploit of the *Nautilus* most certainly qualifies as a team effort. This is an indication of the obvious fact that modern techniques for exploration now demand more skills, more specialized knowledge and abilities than we can expect to find in a single individual. Modern exploration requires a team; the care with which the team is selected—consideration of their original competence and their effective training, and the smoothness with which their individual contributions can be meshed together—is what will determine the success or otherwise in attaining the goal. The functions of organization, of guiding the team effort so that every member is contributing his maximum, are all-important.

It is important to emphasize here that the growth of the explorer team has not reduced in any way the requirement for intense individual effort from the team member. Nor should it diminish the personal incentives or the sense of individual accomplishment, which every member of the team can feel when the goal is reached.

The role of industry in the exploration of space is now very evident. More than any other mission upon which we are now engaged, the development of space flight will require team effort during the exploratory stages of the next few years. The groups which the missile industry has assembled are of course the most obvious source for such a team; in particular the industrial teams which have, during the past three or four years, developed the rocket-propelled ballistic missile appear to combine many of the special skills which are critical in the exploration of space. When discussing an industrial team in this way, I am referring not only to the accumulation of specialists within the organization of a prime missile system contractor, such as we have in Lockheed Missile Systems Divisions (LMSD). I am also including the complex system of links which we have forged by personal contact, by subcontract, or by astronautical society meetings, and which permit us to draw upon the whole resources of our government research laboratories and our industrial specialists throughout the country.

What are the specialist skills which should be gathered together in such a team to permit it to advance most rapidly in the exploration of space? Dr. von Karman, in an address to the A.I.A. about two months ago, stressed the fact that the "foundation" sciences of aeronautics—the mathematics, physics and chemistry underlying our rapid advances in airplane structures, propulsion and dynamics—are still the major contributors to flight in space and successful return to the earth. Problems of navigation, of conditioning of the environment particularly for the human occupant, represent considerable extensions of our developments for airborne vehicles; yet they *are* extensions, not fresh starts. Dr. von Karman's speech was in fact a request to apply to space flight all the know-how which we have accumulated in our present more restricted flight, and not to shoot off enthusiastically rediscovering things in all directions (as we occasionally have a habit of doing).

An even more important question is: What does our individual team of explorers currently lack which might jeopardize the success of the mission? In reply to this question, I'm not going to say "we have it all." We don't! Many of the answers we want can only come from a good astronautical research and development program; we cannot expect to make up the deficiencies of years of inadequate effort by a sudden spurt of a few months. Even now, after all the clamor throughout the country for accelerated space research, we are getting back from space only a small fraction of the environmental information which our competitors are obtaining from Sputnik III. We *must* put more effort on getting back data from space.

We are also lacking in research facilities. As an example, we have been working at LMSD for some time in the problems presented by space structures—structures which have to carry no weight and no aerodynamic drag. The most efficient constructions for these conditions are light and thin; they may not even support their own weight on the ground. How do we check out such structures on the ground before putting them into orbit? There does not exist at present any facility which would enable us to do so. What is worse, there are very few ideas about how to make such a facility. It is quite possible that the next research laboratory to be built by the U. S. Government will be on an elongated elliptical orbit. I'm sure that there are many who would be very willing to participate in the building of this laboratory! Collectively in industry, in government and in the universities, we are ready to meet the challenge.

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PHOTOGRAPHY

and the search for knowledge

by
Donald McMaster
Vice President
and
General Manager
Eastman Kodak Co.

THERE IS BOTH pathos and grandeur in man's eternal search for knowledge. He has his moments of bewilderment, errant convictions and childlike despair. But he also has his times of triumph when intensive work, insight, and inspiration bring him, suddenly, to new understandings of his world and of himself.

His progress is the product of his curiosity—of the endless effort to satisfy it. He abhors uncertainty—he wants answers—he must know. This driving urge to know has led him to devise remarkable means for expanding and disseminating his knowledge.

Would he measure the passage of time and know the time of day? The sun dial and the hour glass served until the pendulum was invented and he had fashioned a mechanical clock. Did he aspire to know the stars? He reinforced his eyesight, first with the simple telescope of Galileo, and later with the giant eye of Palomar. Would he know where he is upon the trackless sea? The magnetic compass and sextant first gave him the answer. Today, the pilot house is a maze of electronic instrumentation.

Thus, man has refined—and refined again—the instruments and the methods used to expose the secrets of the earth and of the universe.

But you will recognize that, throughout the history of civilization, there were certain barriers to learning—to knowing—which constantly frustrated man in his search for knowledge. These were barriers which his natural powers of observation simply could not penetrate.

How, for example, was he to study phenomena too rapid for the eye to follow? How study the interior of the living body? How penetrate the cosmic dust which hid half the heavens from his view? How detect and classify the rays that reached him from outer space? For a long while, he did not know that there was momentous information hidden within an invisible spectrum. It is clear that his vision was seriously limited until, by his own genius, he devised an artificial eye which he called photography.

It was thus that whole new areas of information were opened to him—and the search for knowledge was vastly accelerated. Yet, all that has been accomplished until now seems almost insignificant when we contemplate the immediate future and, in particular, the potential results of combining the photographic and electronic sciences into a single tool.

It isn't easy to gain a clear perspective of all the events that have led to the point where we now stand. So much of the history of our discipline appears to be the result of chance and haphazard progress. Certainly, the ancients who, long before Aristotle, discovered the sensitivity of silver compounds to light had no conception of its significance. The German scientist, Schultze, may have been dimly aware of the possibilities when he experimented in a scientific way with the sensitivity of silver compounds, but Thomas Wedgewood, nearly a century later, was merely looking for a short-cut to silhouette making. Rontgen discovered the X-rays while studying the discharge of electricity.

Thus, the art and the science of photography developed, to a large extent, on an empirical basis. But the inherent possibilities drew dedicated researchers. Perhaps we can credit the work of Fox Talbot, started in 1835—he discovered the development process in 1841—with establishing the scientific foundations on which photography has since been built.

It is interesting to speculate on which particular development or present day use of photography would most have amazed those who lived a century ago. A good case can be made for the ability of photography both to compress and to extend time. The seconds and minutes and hours of the day are merely the fractional parts of an unvarying rhythm—the precise ticks which beat out the ponderous turning of the earth. You might say there is an inevitability about time that leaves little scope for applying the ingenuity of man. Yet, the irreverent photographer has stepped in and worked his magic in a way that would surely have amazed earlier generations. But to us, wise as we are with hindsight, the truly astonishing feature is the versatility with which this tool is used to learn and to teach. An interesting example of several years ago remains fresh in my mind. The railroads were faced with a baffling problem. It was known that the drive wheels of steam locomotives traveling at high speed would leave the rails at some point in the piston cycle. But at what point—and why—and to what height the wheels jumped, no one could determine. The photographer was appealed to, and his high-speed camera gave all the answers. From the layman's point of view, it was an eerie movie—the great drive wheels slowly turning and rising leisurely from the rails at each revolution.

And suppose an audience of one hundred years ago could have watched the hummingbird poised on wings which beat so deliberately that the action of every feather could be studied with ease. Here was clear evidence, that they should not believe their eyes.

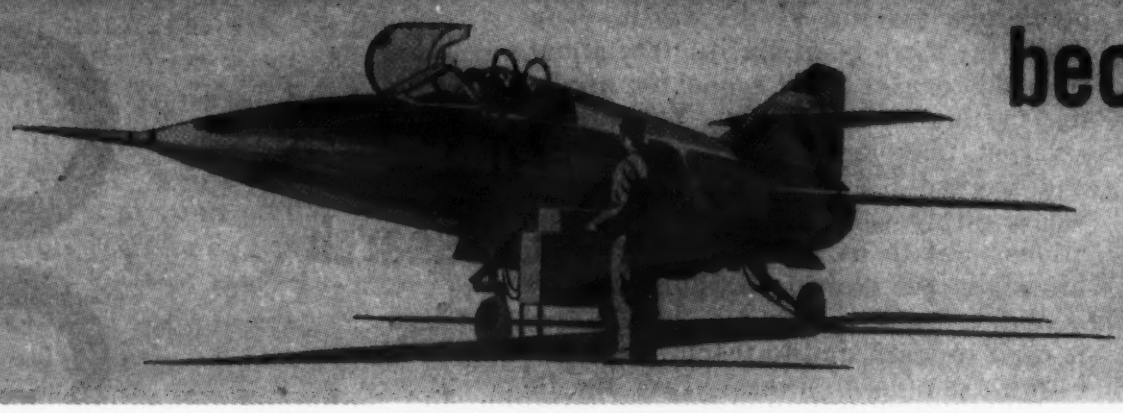
Well, this is spectacular business—but you and I are aware of its utilitarian value—of the countless uses made of high-speed photography to expand knowledge in the research laboratory, on the production line, and in the wind tunnel. One might say fairly that the photographer has made sport of supposedly invariable time — but he has added vastly to the sum of useful knowledge in the process.

The ability of certain nonvisible rays to penetrate solid substances, and the actions of those rays on sensitized ma-

(*Continued on page* 17)

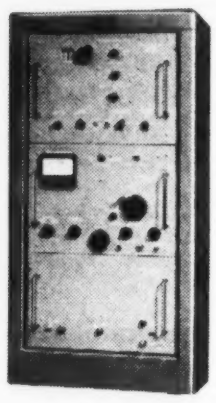


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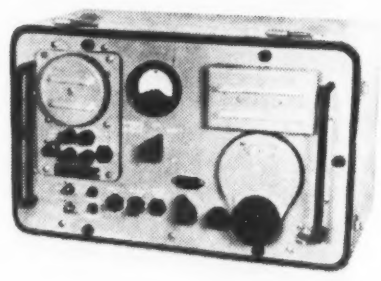


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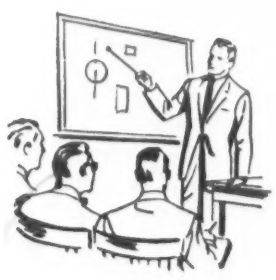
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Photography

(*Continued from page* 15)

terials, are phenomena that we take pretty much for granted. Yet, here again, what a formidable barrier to learning has been diminished by science. Nowadays, the doctor makes his diagnosis with greater assurance. These shadow graphs help a manufacturer to determine if a casting is free of faults —or if a weld is sound. The added safety factor in the construction of air frames is a prime example of the valuable knowledge which only X-ray photography can provide.

But photography—as any other tool —is not an end in itself. It is a means of gaining information that usually can be gained in no other way. What kind of information it will lead to in the years ahead is an interesting question.

Let's take a brief look at the present situation and at some of the prospects.

Many of the technical papers recently presented before the Society of Photographic Scientists and Engineers demonstrate the considerable progress already made in designing special cameras and lenses for tracking satellites and missiles. This work is suggestive of the contributions that will be made in bringing back information from outer space.

What challenges does the photographic industry face in the coming era of space technology? For the time being, we recognize that the industry is largely preoccupied with military considerations. These, undoubtedly, will remain the paramount concern for the duration of our current state of national peril. But, looked at long range, the study of space will surely occupy attention to an increasing degree—simply because space is there and man's insatiable curiosity will drive him to explore it—much in the way he is driven to climb the highest peaks.

We may be sure that much of the information about outer space will be obtained by photography. Just as the camera has been the astronomer's indispensable tool, so it will probably be the primary tool of the space scientist. Photography's role in this field can be readily foreseen.

Take man's first exploration of the moon. We may safely predict that rockets in orbit around the moon will be the first successful instruments for relatively closeup study of the moon's surface—including the moon face which remains forever hidden from direct earthly view.

How are these orbiting rockets to give us the information they are sent to gather? Television has been suggested, but even with the great increase in the strength of its signals which has recently been achieved, there seems no likelihood that we could ever directly produce a sharply detailed television image because of the high resolution required.

Photography, however, practically guarantees a satisfactory solution. Your imaginations will hardly be strained if you conjure up a rocket carrying automatic cameras with telephoto lenses and automatic processing equipment. Add the TV system needed to scan the finished film minutely and transmit the image back to earth and you have a capable instrument for doing the job. This possibility, I dare say, strikes you as much less fanciful than did the idea of sending photographs by wire or wireless when this was first proposed a relatively few years ago. True, we don't yet know what difficulties may be caused by cosmic rays or other radiation. But we're finding out something about that.

When man himself eventually goes out into space, it's a dead certainty that he'll take his cameras with him. Of course, he may need some special optics —some newly designed equipment—incidental problems, I should say, which the photo industry will have to solve for him. And, of course, one speculates on the life expectancy of the first space travelers and their equipment.

In connection with all this, there are current plans to study the spectra of Mars from a high-flying balloon. From 100,000 feet above the earth, it is hoped that much can be learned about the atmosphere of Mars and especially about its water content. Surely, these efforts foretell the day when men will visit this provocative neighbor of ours. For just as surely as this indomitable creature has moved out of the cave to his present estate he will set foot on other worlds. You and I may not live to see his triumph, but we know that photographic scientists and engineers had better get busy with their preliminary assignments all the same. There is much celestial reconnoitering by photography which must be done in advance.

One of the most interesting subjects of astronomical research is, of course, the sun—and here again photography is the basic tool of learning. Man's interest in the sun is natural enough—even the ancients recognized it as the source of all life. Early religions, including those of the first American civilizations, centered around worship of this nearby star.

Until photography and electronics started unlocking its secrets, the sun appeared to be a fairly stable performer. We have long since learned that this appearance is a deceptive one. By continually photographing its surface, astronomers have learned much about the violent activity of this atomic furnace. As many of you know, a number of observatories around the world keep a continuous photographic record of the sun's activities. The information they gather has great practical value. Already, long-range weather forecasting based on the study of sun spots is beginning to show dependable results.

It has been said that photographic plates are a basic tool of the nuclear physicist. And this is true. The nuclear physicist has been largely dependent on sensitized materials for his information. What happens in a Wilson cloud chamber or in a bubble chamber can be recorded for study only by photography. The charged particles which whirl around at fantastic speeds in the so-called atom smashers strike photographic emulsions and leave their characteristic tracks for later study. Our knowledge of cosmic rays has come largely from photographic evidence. The study of cosmic rays, incidentally, has presented the film maker with a unique problem. To record the track of these penetrating rays, an unusually thick emulsion is required—so thick, in fact, it could not be satisfactorily processed as a single layer. The answer has been to prepare emulsion in layers —layers, of course, with no film support. In turn, after exposure as a block, these layers are separated for developing and then reassembled in a precise way so that they are in perfect register for study.

Perhaps no other development of recent years has called attention to photography's untapped potential as have the electronic computing systems. All the functions of photography—the recording of information—the storage of information—the retrieval of information—are here brought into play in a way to stagger the imagination.

For example, as of today, the output of electronic computers can be recorded by photography at the rate of 100,000 characters a second. We foresee a rate of 1,000,000 characters a second in the near future. In fact, photography can record faster than the computer can compute. Because it can, photography has made it possible to use the highly expensive computer at full efficiency. The small amount of energy required for photographic recording renders this method faster than the electrostatic and magno-photographic methods of recording.

Photography can also provide the "memory"—the built-in information—on which the computer feeds. At the present time, a computer is being programmed to translate Russian into English. The information it must have to do this is provided on a 12-inch disc where 60 million discrete bits of information have been transcribed by photography. And only part of the surface of the disc is used.

Today, computers are being used to analyze vast quantities of information and to sort out or extract the new or wanted material. It is an actual fact that, by this method, a thousand papers on a given subject can be scanned—the repetitive sections eliminated—and a condensation of the information produced on a photographic film.

As the electronic computers build up vast stores of new information, the problem of storage and retrieval will grow increasingly acute. But photography appears to be fully equal to these problems. By photomicroscopic means, not only can incredible amounts of material be condensed into a tiny space, but effective methods have been devised

Photography

(*Continued from page* 17)

for obtaining quickly any specific information from the file. Efficient as these photographic methods of storing and retrieving information already are, great advances are undoubtedly on the way. Today, we store information photographically in two dimensions. Perhaps, in the future, we shall add the third dimension—depth—just as we already have in the study of nuclear events. Add color, and we can increase the storage capacity of film by several orders.

The use of photographic methods for retrieving stored information is growing quite common. But the benefits of these systems have scarcely been realized as yet. We can, however, safely forecast some of the possibilities. Consider, for example, the storing of all known medical information in a single place. The physician, faced with a rare disease, could telephone to this center and, within a matter of minutes, have the precise and most useful information needed out of all medical history for making his diagnosis.

The use of photography in storing and bringing information to men clearly has incalculable value. So important is this technique that it will certainly speed remarkable new developments in the science of photography. I think we can look for photographic materials capable of being processed with great simplicity. Perhaps the younger or the next generation of photographic scientists will devise methods for reading the latent image—rendering development wholly unnecessary for some purposes. Think how this would speed computer operation—one can imagine a computer being fed with information contained in latent images and its computations being made instantly available through latent images. By what means the latent image is to be read, probably no one yet knows, but it is possible that the answer will be found in time.

Nowhere have the capabilities of the computer been more dramatically displayed than in their use in designing lenses. The arduous and interminable calculations once carried out on manual calculators can now be completed in a matter of seconds.

When we review all the remarkable achievements in the photographic field, we inevitably wonder what is yet to come. The rapid advance in photographic technology which we have witnessed in recent years suggests rather startling developments in the future. Think of the entirely new concepts which have invaded the field in recent years. The Land Polaroid camera, for example— who could have foreseen the rather brash way in which this hand-held instrument dispensed with the darkroom? Yet, more amazing things are in prospect. Before too long, the diffusion transfer system or similar systems may be producing prints in full color about as readily as in black and white.

When my own company came out not so long ago with a new copying method known as Verifax, it was considered quite notable that development of the paper was carried out with a single solution. And indeed this was quite revolutionary. We have every reason to believe that even more startling advances will be made.

Of particular interest to many must be the great advances in the resolving power of films. There are films available at the present time which can clearly resolve 2,000 lines to the millimeter at low sensitivity levels—a capacity which actually exceeds that of present-day optics. As better lenses are designed, the value of these films can better be utilized.

Again, the speed of sensitized materials has been, and is being, multiplied over and over again. Films with an equivalent exposure index of 6400 and greater are being produced—films, I might add, with stable characteristics. It wasn't so long ago that an equivalent exposure rating of 200 was considered exceptional. Furthermore, a greater variety of film characteristics tailored to specific uses is now available to the scientist and the technician. Advances in emulsions for spectroanalysis are good examples of this.

Simpler and faster methods of processing come in for a great deal of research. It shouldn't be long before films can be viewed almost instantly after exposure. We may expect that color processing will be greatly simplified and color prints will be less costly for the customer.

It would take a rash man to predict the developments another ten years will bring. We know that the usefulness of photography will be vastly expanded. We can be certain that our present efforts—our present programs—will lead us into new paths.

In view of photography's immeasurable usefulness to society, we can see that every forward step of the photographic scientist and engineer has great social significance. Increasingly, the expansion of man's knowledge will depend on their work. Increasingly, education and communications will be advanced by their work. The health and welfare of men fall to their care in ever greater degree. And it may well be that it is they who are destined to open up whole new areas of knowledge never before revealed in the whole history of mankind. Matters now susceptible to nothing more than vaguest speculation may tomorrow be revealed in clear and incontrovertible terms by photography.

I say this because man's driving urge to know must carry him far beyond where he stands today. More barriers to knowing will give way to his persistent probing. Photography will bring new understandings, for certainly, we have not yet found the limits of photography's broad capabilities as a revealer of knowledge.

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The Challenge of Space

(*Continued from page* 6)

procedure, it is possible to locate the position of an aircraft to within a distance of only about five miles. These methods break down completely when an overcast renders the stars invisible. With a satellite in orbit with a continuously transmitting radio beacon or one that will transmit when queried by a ship or aircraft, it would be possible to locate the position of such a ship or aircraft to within a few feet. The practical economic values of such an aid to navigation are immediately apparent.

As we go from a contemplation of the satellites already in existence to space travel which is now in the immediate offing, we can predict with even less certainty the practical values of such endeavor. One possibility, of course, is that on the moon, or the planets, or the planetoids, we may well find sources of scarce materials which are urgently needed in our expanding economy and technology. For example, it has been estimated that an iron-nickel asteroid of usual meteoric composition having a diameter of only 200 feet would be worth one billion dollars at today's market prices.

But these possible benefits are all of a rather mundane and commercial nature. It does not take a great stretch of the imagination to see a much more far-reaching challenge in our exploration of space. This is the possible ultimate salvation of the human race. Much has been said and written in the past several years of the possibilty of racial suicide as a direct result of the development of nuclear explosives. Although I do not believe that even all-out nuclear war would result in the absolute eradication of the human race from the face of the earth, I do not consider it beyond the realm of imagination that ultimately man might completely destroy himself on the face of the earth as a direct result of his own scientific curiosity. The full potential for such destruction through the release of vast new sources of energy has not yet been reached. This is an ever present, though I believe remote, possibility.

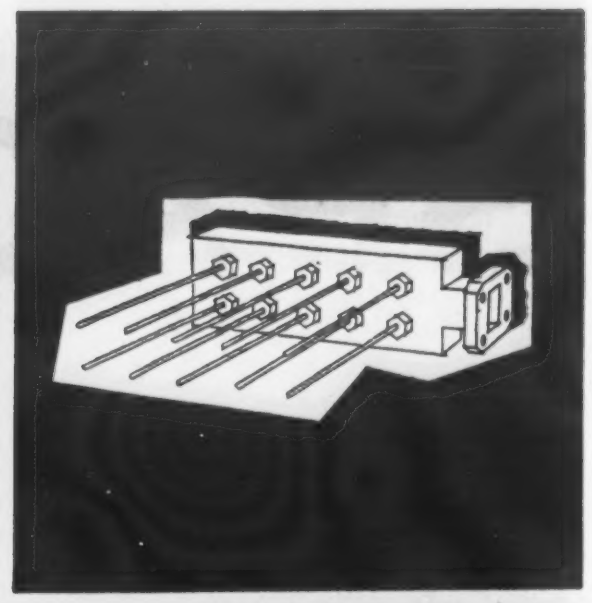
There is another and equally intriguing possibility. Man is continually playing with the balance of nature, attempting to eliminate pests from the surface of the earth by encouraging their natural enemies. It is not inconceivable that in some such manipulations of the future, man might so far destroy the balance of nature that one of his own natural enemies, for example the insects, might take over and destroy him.

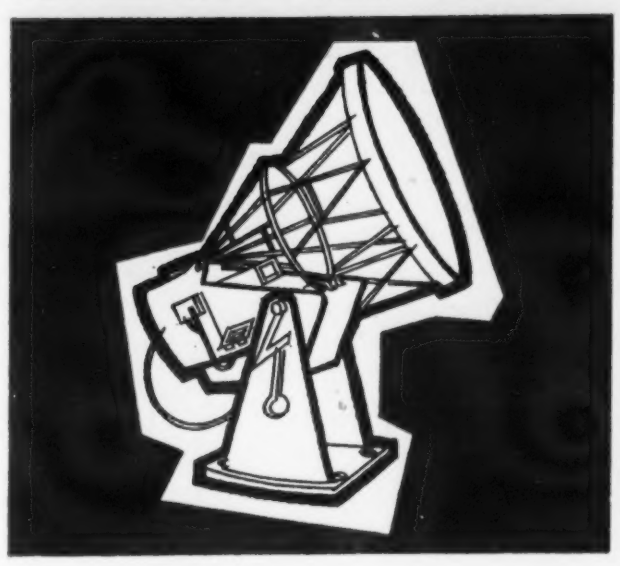
In the event of either one of these remotely possible catastrophies, the salvation of the human race might well lie in the ability to establish or in having already established outlying colonies on other planets beyond the reach of the destructive influence.

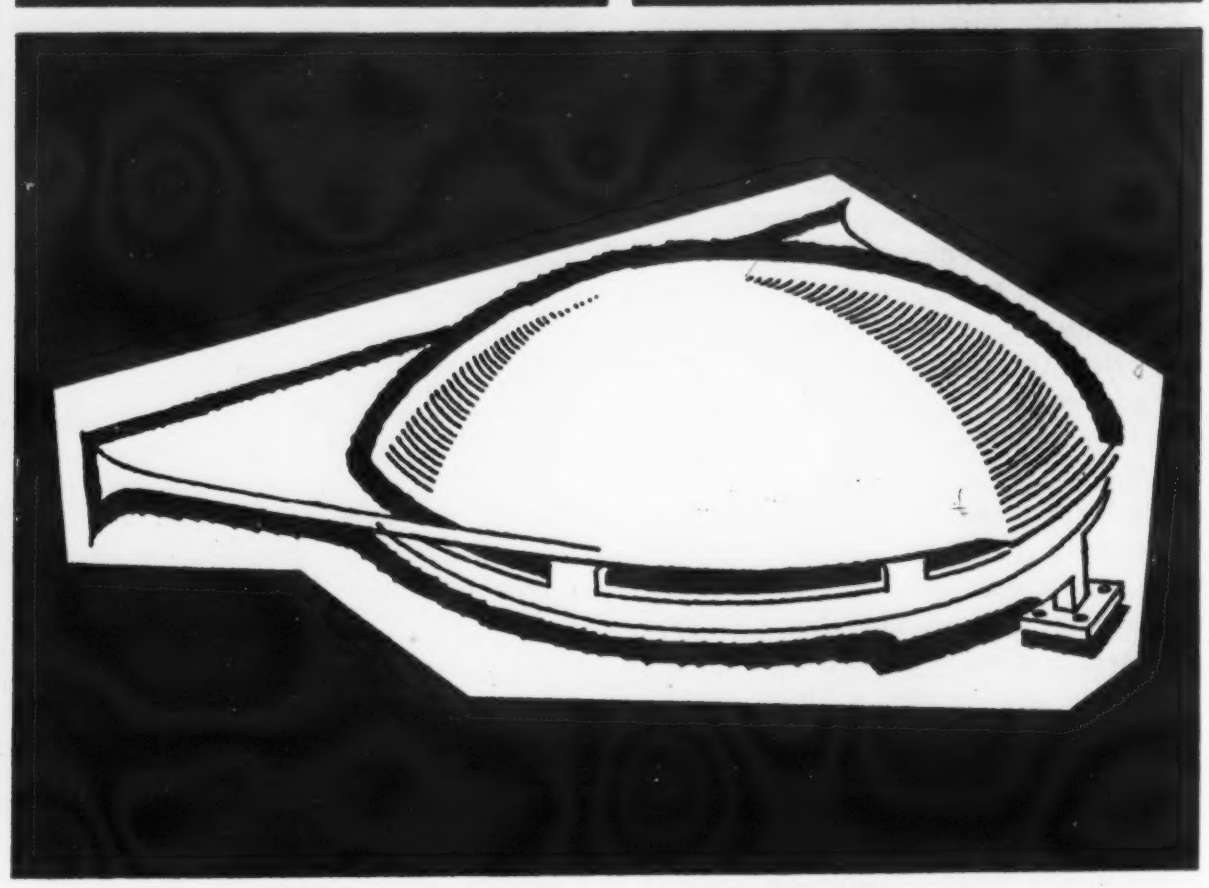
Part II will appear in the March issue.











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SPACE *communications*

by Major E. N. Wright, USAF
Chief, Communications Div.,
Electronics Directorate,
Air Research and
Development Command

THE WORLD'S ENTRY into the space age has introduced new means of achieving communication. It has also created new problems of communicating in the environment called space. The intent of my discussion is to relate these means and problems to Air Force communications. First of all, let me state in essence the military problem. The necessity for the Air Force to operate on a global basis introduces the problem of providing effective control over the operations of the various organizations concerned, regardless of geographical location on or above the Earth's surface, and under all conditions of atmospheric electrical disturbances, weather, and enemy interference.

Having stated the military problem, let us treat this subject with just a few words. The effectiveness of any organization is directly dependent upon its communications links. This is especially true of military organizations. These communication links may take almost any form—from wire lines to radio, from audio to visual, from continuous signals to impulse-type transmission, and from picture to written messages. Regardless of the type of transmission employed, the objective is the same; i.e., to transmit and/or receive a wide variety of intelligence such as military commands, operations orders, and reconnaissance information with the required security.

Now that we have outlined our requirements, what are the tools by which we can accomplish communications for the Air Force today? First of all, we possess no magic not known to others who are required to communicate on a global basis and must therefore use the same methodology. We propagate our intelligence by means of the ionosphere on a global basis using the HF spectrum. We utilize wire and cable where it is available to us. We employ microwave circuits and, more recently, have introduced the use of tropospheric scatter and ionospheric scatter for varying requirements between roughly 150 and 1500 miles. This had been a limitation of our communications prior to the time that space came knocking at our door. Now we are faced with a requirement to communicate in an area that is so vast that the entire geographical regions of the globe seem minute by comparison; for example, our nearest neighbor, the Moon, is 250,000 miles away and Mars in its closest position is in the order of 40,000,000 miles. However, there are certain compensations for our entrance into this space age, and we may be able to turn this entrance into the regions beyond the atmosphere into a tool that may assist us in performing global communications.

First of all, let us examine some of our requirements for communications in the Service today and which will be with us tomorrow and even in the future when man regards space as a familiar territory.

First, the ability to handle increased volume of traffic. The limitations of economics and available spectra have placed the Air Force in the position of never completely satisfying the demands of their operational personnel. Coupled with this is the second requirement to achieve greater speed, flexibility and reliability in traffic handling. These two requirements go hand in hand. Third, we have the rapid transmission of video information. This is becoming increasingly important, especially in military circles where decision times are so short that a maximum of information transfer must take place in the shortest possible time. Here it can be truly said that one picture is worth a thousand words. Fourth, for strategic purposes, it is obvious that we must have world-wide air/ground and ground/air coverage on an instantaneous basis. And, finally, in order to keep our communications effective we must insure that vital military information is protected through increased security in the transmission of intelligence.

Communications is no stranger to space. In fact, communications has been utilizing space since its inception. Our problem is, How do we transfer the methodology of communications into space? Herein lies our problem, for the things that limit us essentially are items that are of a noncommunicating nature when we consider operations in the near regions of space; for example, we have a requirement for stable platforms, secondary power that does not pay a tremendous weight penalty, and finally the men who build propulsion devices to lift our vehicles from the surface of the Earth must be able to put sufficient payload in the space environment so that we may carry out our job. This is not to say that people are not working vigorously in these areas, and I will have more to say on such subjects later. I think it can be said very specifically that the building of blocks of space communications are at hand and that a firm foundation is under construction.

As we go forth into space, certain problems become more apparent to us in the transmission of intelligence through electronic communications, but they are not new thoughts or problems. To place this in proper perspective, consider these comparisons.

First, in Figure 1, let us look at the transmission loss characteristics of this ionospheric scatter propagation measurement. We can see that our transmission losses at ranges in the order of 14 to 16 hundred statute miles fall in the order of around 220 db. This was with a relatively high gain antenna system on the transmission end and some gain on the receiving aircraft antenna.

Now let us consider a path loss measurement which concerns a natural satellite; namely, the Moon.

It has been demonstrated successfully that we have a path loss in db between two isotropic antennas using the Moon as a reflecting device; and as you can see, the total loss in going between Earth, the Moon, and back, considering the loss in the reflection from the Moon's surface and the fact

that we are now dealing in approximately 500,000 miles range, is not too much in excess of that considered in the best ranging figures we could get in the ionospheric scatter slide mentioned in Figure 1. Thus, the requirements of communicating in near space are not spectacular and different from those which we have been willing to consider in our attempts to transmit intelligence reliably within our known atmosphere.

This does not mean that new problems are not of concern to us. On the contrary, in looking at space we must bow to the radio astronomer who in his quest for knowledge of the stars and our solar system has found that there are certain disturbing elements that we must consider when we examine the reaches of space. For example, receiver sensitivity which is affected by some of the noise sources that face us as we look into outer space; for example, noise generated in the galactic plane and disturbed solar bursts can account for receiver sensitivity losses at certain frequencies as much as 20 to 30 db as shown in Fig. 2. It also serves to demonstrate that certain portions of our frequency spectrum which heretofore have been the only means of communications on a global or semi-global basis may now have to be discarded.

Conversely, other frequency ranges which heretofore have been prohibited by the geometry of our Earth's surface may now be available for use since we are dealing with line-of-sight relationships; in addition, it can be seen from the noise considerations shown here that once we have reached a value above 1000 megacycles, cosmic and/or galactic noises cease to be a major problem in degradation of signal. Now that we can consider the transmission of these higher frequencies, our limitations reduce themselves to what we can get through the atmosphere in propagating energy into space. The answer is of course determined by the angle at which the energy leaves the Earth's surface and the upper range of frequency values that are sensitive to water absorption; for in military design we can not consider only those periods of time in which water absorption does not exist, but must instead design our system against the worst conditions in order to insure a high reliability factor.

Space Environment

In speaking of reliability we must now consider some of the more serious problems of how do we maintain and support electronics equipment in a space environment. The obvious answer for man's early struggles in space with unmanned vehicles is that there will be no maintenance. We cannot design and build equipment unless we are prepared to take every precaution to provide an inherently useful life in thousands of hours for the equipment rather than settling for statistical averages which lead to a mean time to failure of a few hundred hours. It makes little sense to spend huge funding efforts to launch an extremely complex vehicle and then negate all the time and economic resources employed for the lack of electronic component or circuit reliability. The question can be asked, Is this custom-built approach feasible? The answer is, yes. Several of our common carrier concerns in this country have developed and built submarine cable amplifiers which have functioned perfectly over extended time periods. This solution *will work*, expensive as it may be. However, the case for ultra-reliability must not be rested and every effort will be made by the Air Force and other military agencies to achieve a capability for electronic equipment that can be spoken of in terms of thousands rather than hundreds of hours of operations.

I have previously mentioned that the three applied research areas of satellite guidance and stability, secondary power, and propulsion were limiting factors in obtaining a space satellite communications capability. A few words on each of these areas seem appropriate at this time. It follows that for all classes of satellites, the control and guidance system must place the satellite in its prescribed orbit such that orderly, programmed operational use may be made of it by the ground agency. For low altitude elliptical orbit satellites, present state of the art development will allow us to obtain satisfactory orbits. However, in the case of the earth-orbiting synchronous 24-hour satellite (either active or passive) that offers the ultimate in a communications relay satellite, the state of the control, guidance, and satellite stabilization art must be considerably advanced. Typical requirements for one future Air Force application indicate the satellite must not only arrive in its orbit at the correct altitude with the correct velocity to synchronize with the Earth's rotational speed, but must also be held accurately stabilized to plus or minus 1/4 of a degree in attitude with respect to a point on the earth and must not drift more than 1/4 of a degree from its correct position in one year's time.

The present state of the art in secondary power is one that must be thoroughly expedited as can be shown by the fact that for light-weight satellites requiring 100 watts of secondary power, its weight comprises approximately 70% of the total payload while the communications equipment weight is only 5%. These figures will improve such that it is anticipated that by the end of five years the weight of 1200 watts of secondary power for a several thousand pound payload satellite may become as low as 15% of the total payload. Another limiting factor of secondary power is the ability to obtain constant power for long periods of time.

Figure 3 shows the variation of the weights per kilowatt versus time duration in days for chemical, solar, and nuclear secondary power systems. It indicates that chemical power systems are competitive with solar

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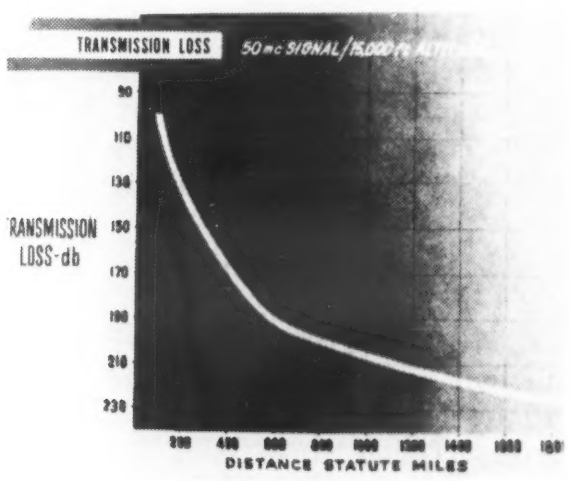


Figure 1

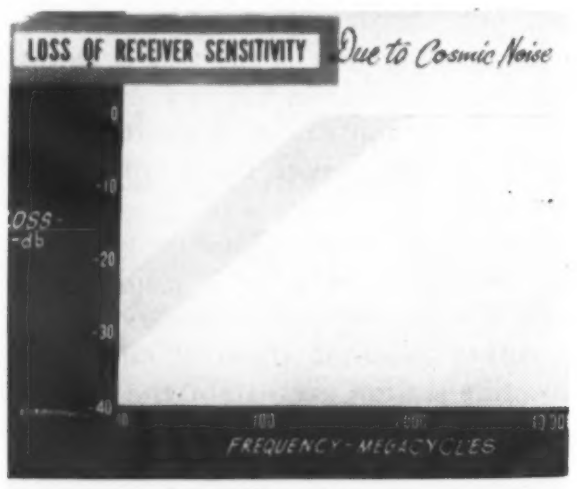


Figure 2

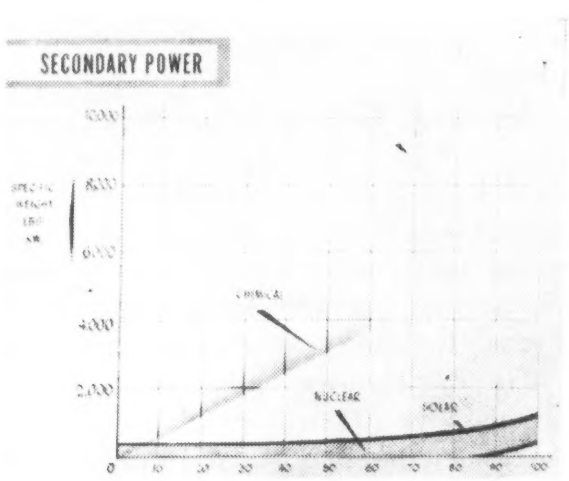


Figure 3

a Letter to the Editor

SIGNAL GETS AROUND



Marconi, pioneer in wireless telegraphy, sitting by his crude instruments at Newfoundland where he succeeded in getting the first letter S across the Atlantic in 1901.

Editor
SIGNAL
Dear Sir:

A copy of SIGNAL, December 1958, has reached me through the courtesy of my good friend Maj. Ralph Thompson, Hqs. Yukon Command USARAL, Fairbanks, Alaska.

This is my first opportunity to read your interesting publication pertaining to communications and the progress of the electronic art, and this issue is of particular interest to me, due to the two excellent articles on amateur radio.

I am 70 years old. I became interested in amateur radio in 1906, in the very ancient days of the magnetic detector and the coheerer-tapper, and I was on the air long before 1912. Passing through the era of Dr. Greenleaf W. Pickard's new discovery of the rectifying property of minerals, I used everything from galena, silicon, calco-pyrites, molibdonite and carborundum to the original Flemming valves, the Audiotrons and the pioneer struggling with loose-couplers, loading coils and Murdock phones.

My first license, when they were required in 1912, was 1 BI. From this I became a commercial radio operator. When I read in the newspaper that America had declared war on Germany, I went immediately and joined the Navy as a radio man.

No one knows better than I the tremendous importance of the title of the article by Brig. Gen. John Bestic: "America's Secret Weapon." In communications the ham operator is our greatest secret weapon.

This is also true of Col. Fred J. Elser's account of the amateur radioman in the services. Col. Elser tells of the work of Fred Schnell. Fred and I were shipmates, watchmates and bunkmates at the old Marconi station at Belmar, New Jersey, during the middle of 1917, when the Navy took over that station in the attempt to set up the first transatlantic naval radio communication with our Allies abroad. Fred is now retired with the rank of Captain, and is living in Bradenton, Florida.

At that time, all that could be found, who were ex-amateurs and suitable for this work, were about 35 of us. Every one was a volunteer. I was sent to Bar Harbor, Maine, during 1917 to examine the possibilities of radio long-wave reception there on the coast of Maine. There I met another amateur. His name was Allesandro Fabbri. He was a man of considerable wealth, who had given his ship to the government; had purchased, with his own funds, a large estate and equipped a radio station. All this at his own expense, and furthermore, he also had enlisted in the Naval Communication Service.

Amateurs here. Amateurs there. Amateurs everywhere. It would have been utterly impossible to have done anything without them. Suffice to say, this station grew to be the largest and most important radio station in the world. The accomplishments of that station may be judged from the fact that Lt. Fabbri was awarded the Navy Cross and a citation from Congress. There will probably never be another occasion for a single station to handle all the spark and arc work from one location, including all the correspondence with our Allies; all the diplomatic and consular traffic; all the ships at sea and the necessity of abstracting over 400,000 words a week.

After these 40 years, it is interesting to note the accomplishments of many of those young men, who were simply experienced and patriotic young Naval operators at that time. Col. Elser has already spoken of Fred Schnell. Fred Meinholtz, who was a traffic chief, has been in charge of all communication for *The New York Times* for some 38 years. Ralph Elliott became chief operator of Radio Corporation of America. Wilbur Manning just retired as head of E. I. Du Pont, New York office. Jack Miller became Kate Smith's band leader. Cheslie "Shorty" Chisholm, who was voted the most popular communication officer in the South Pacific during World War II, has just retired after many years of Naval radio communication service. Space will not permit enumeration of so many others.

I became general manager of a large radio wholesale house in Boston and was associated intimately with amateur radio and the American Radio Relay League in West Hartford, Conn. I was twice communication

(Continued on page 25)

Space Communications

(*Continued from page* 21)

and nuclear systems for durations on the order of ten days. For durations over ten days the specific weight of chemical systems increases very rapidly while that of solar and nuclear systems increases only slightly with duration of operation. This increasing weight characteristic inherent in all chemical systems eliminates it as a secondary power source for space applications requiring power for extended periods of time, for all but low power intermittent use on a rechargeable basis.

In the area of propulsion devices,

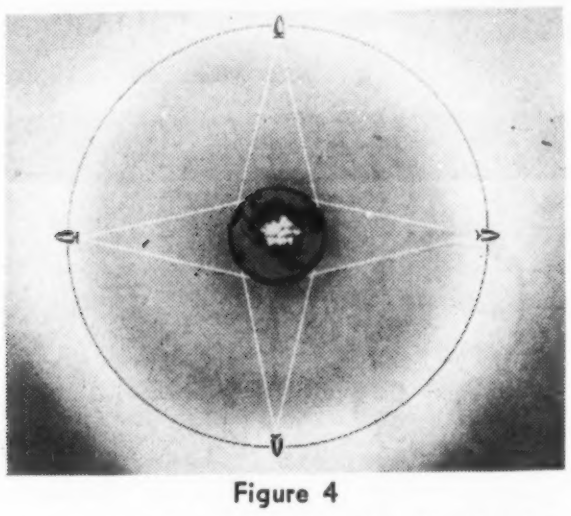


Figure 4

severe problems exist in developing the necessary rockets to place large masses in near Earth circular orbits and propelling other vehicles far out into space.

For the near future things look considerably better as low altitude near Earth satellites may be launched using combinations of existing propulsive developments.

To define some possible parameters, let us examine Figure 4, an artist's concept. We see here an active relay system comprising four Earth synchronous communications satellites working in conjunction with four ground stations. Communications between each of the four stations can be accomplished by multiple ground-satellite-ground relay. The potential geometric relationships existing here can be used to minimize a potential enemy's capability to jam this environment unless a somewhat sophisticated arrangement involving enemy active satellites is employed. It appears that an adequately expedited Applied Research Program in propulsion devices, control and guidance systems, and reliable satellite communications equipments will permit such a synchronous satellite system to become a future reality.

I wish to briefly summarize the following points:

(1) The main problems in realizing a satellite communication system involve achieving accurate orbital and attitude stabilization, propulsion devices of sufficient magnitude, and adequate secondary power.

(2) There is general agreement as to optimum frequencies, propagation path losses, power requirements, and ground and vehicle antenna requirements of communication via a synchronous orbiting system together with the trade off of bandwidth versus the various parameters that must be compromised in achieving practical solutions.

(3) It appears that communication techniques and equipment design can be made available to meet the requirements of reliability required in the satellite environment; and extension of our present tropo-scatter type of equipment can provide the design background for the ground terminals required for such a system.

Finally, we are now on a frontier of a new age in communications—the technical feasibility of all the tools for space communication has been demonstrated, and it is self-evident that military applications of this type of communications will have a tremendous potential for improving national defense.





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And as for the many hats, those shown above have been worn on these representative programs: **A** *Integrated Battlefield Communication* **B** *Supersonic Rendezvous and Station Keeping* **C** *High-speed Tank Range Finder* **D** *Test Range Microwave Relay System* **E** *Ballistic Missile Radio Inertial Guidance System* **F** *Shipboard Surface-to-air Missile Guidance* **G** *Member, Army Scientific Advisory Panel* **H** *DEW Line Air Defense Radar* **I** *Strategic Bombing Radars* **J** *Amphibious Landing System* **K** *Shipboard Air Defense Data System* **L** *Tactical Drone Guidance.* For data on how Motorola's military experience can be applied to your problem...or for detailed information on engineering career opportunities...write to: Motorola, Inc., Military Electronics Division, Dept. A, 8201 East McDowell Road, Phoenix, Arizona.

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MOTOROLA

Military Electronics Division

(*Continued from page* 22)

manager of New England.

Among the old timers who are still living, I am known all over as "Old Hot Wire." I acquired this nickname in the old days by building so many hot-wire ammeters for measuring comparative antenna current.

Looking back over my three score and ten years, and a half century of interest in radio, I can recall many pleasant memories: my close association with Hiram Percy Maxim, father of amateur radio and the association with such men as Alexanderson, Steinmetz, Taylor, Admiral Hooper, George Clark and Elmer Bucher. I am the central point of information of these old timers and in contact with many of them.

After World War I, I was very active in amateur work as 1 UQ. After that I was W1 11E. Having fully retired from business I returned to the town of my birth and I am not on the air at present. I do contact many of the old friends while visiting my old friend Charles B. Ellsworth, who was one of the finest naval radio operators. He is recently in retirement from FCC monitoring and immigration work after nearly 35 years of service, and is a personal friend of Arthur Godfrey, who was in his radio crew on the Destroyer *Reid*. Mr. Ellsworth is active on all bands and has taken up a permanent residence at Ellsworth, Maine, the home of his forefathers.

The Government is building the largest radio station ever attempted at Cutler, Maine. A plan is on foot, which is approved by everyone on the Senate Armed Services Committee, as well as the Commandant of the First Naval District, to have an elaborate commissioning of that station. One of the major parts of it is to be dedicated to Lt. Fabbri, and it has been suggested that I assemble as many as possible of the original men of the old station NBD to be present and send out the first message.

Some years ago, Admiral Hooper supervised the writing of "A History of Naval Radio." I was assigned Chapter 20 and wrote over 165,000 words on that first great station alone. This is all preserved in the Navy files and also in the Marconi Memorial Library at M.I.T.

For some years I wrote feature articles for *QST*, the official amateur magazine, and I have a wealth of material and information to substantiate thoroughly the fact that, in communications, the trained amateur is "America's Secret Weapon."

In reference to the early radio activity of Gen. Mauborgne mentioned in SIGNAL, I might say that in all probability Irving Vermilya of Mattapoiset, Massachusetts, is probably amateur #1. His call letters are W1 ZE. He was with Marconi at Cabot Tower, Signal Hill, St. Johns, Newfoundland, Dec. 12-13, 1901, when Marconi succeeded in getting the first letter "S" across the Atlantic.

You may be interested in the enclosed picture of Marconi, taken at that time, sitting beside the apparatus he used. I still have the original negative. This picture has been copied by many who have written historical articles relative to the development of the art.

Forty years ago every man was simply listed as a radio operator. We found that some were particularly proficient in operating and some in theory. Many of us began to suggest that the two should be divided, and I am gratified that we now have technicians and operators definitely separated. We had some of the finest and most competent operators the world has even known, who probably could not hook up two dry batteries in multiple, and by the same token, some men who were excellent theory men, who simply could not operate.

If we can show all those who are now engaged in our armed forces communications, that those of us, of earlier times, took pride in accomplishments and efficiency, and, that we now sit in retirement, watching and hoping that they will carry on the great traditions, it might inspire some of them to take a greater pride and a consequent improvement in our communications. We must continue to encourage these amateurs who can be of inestimable help in time of national emergencies.

I could not refrain from commenting at length after reading the two excellent articles in your December issue relating to amateur operators and the privilege they enjoy which results in such a reserve of trained men in time of need. Again, my compliments on your excellent publication and the thought that you appreciate the importance of the amateur when he is needed in service.

VERY TRULY YOURS
HAROLD W. CASTNER
DAMARISCOTTA, ME.

Editor's Note: In a subsequent issue we will feature a story by Mr. Castner entitled "Little Acorns." SIGNAL readers will be interested in the historical data and human interest factors which the author has made available and which he relates in a conversational manner.

KLYSTRON

the creative core

★ ★ ★ ★

by A. Frank Lang

Air Vice Marshal, Royal Air Force, Retired

I WOULD LIKE TO discuss the impact of the Varian klystron invention from the British standpoint. We must go back to the early pre-war days when in the United States, in Great Britain and doubtlessly in other countries, the extreme importance of being able to determine the position of an aircraft in the sky and of the earliest warning of the approach of aircraft was keenly appreciated by both military and scientific minds. Knowledge of this vital information would enable adequate defensive measures to be established, and by eliminating the need for exhausting standing air patrols, would economise considerably in the number of aircraft necessary to deal with bombing raids. Radar had been developed in both our countries for this purpose before the war on long (meter) wavelengths and was found to be adequate in the then comparatively crude state of the art, since the long meter waves gave us the long ranges essential to early warning. Under the stimulus of necessity these basic equipments were rapidly developed to a point of high perfection.

As a result of the increasing effectiveness of these early radar ground stations, which stimulated the imaginations of our scientists, and provoked the practical minds of our more enlightened military staffs, demands were made for many different types of operational radar requirements. For example, aircraft interception at night was still entirely dependent on the eyes of aircrews and on the ears and eyes of ground observers. This called for a system of aircraft interception where the limitations of darkness and poor visibility could be overcome by radar ground stations that would accurately determine the position of the enemy aircraft, and would work with and control our intercepting fighters, which also were required to carry radar equipment.

Our bombing accuracy was seriously hindered by the difficulty of finding the target at night, and precision bombing was therefore speculative. If radar could be made to paint a picture in the bomber's cockpit, to show the details of the landscape over which it was flying, above the clouds and at night, its arrival at the target would be greatly facilitated and precise blind bombing made possible.

Similarly, our Navies, coast defenses and anti-aircraft defenses were equally interested in detecting and fixing the position of ships and planes. Their effectiveness would undoubtedly increase if radar could meet their precise needs.

These are some of the primary concepts which soon began to pour in from our men in the theaters, our military staffs and our scientists.

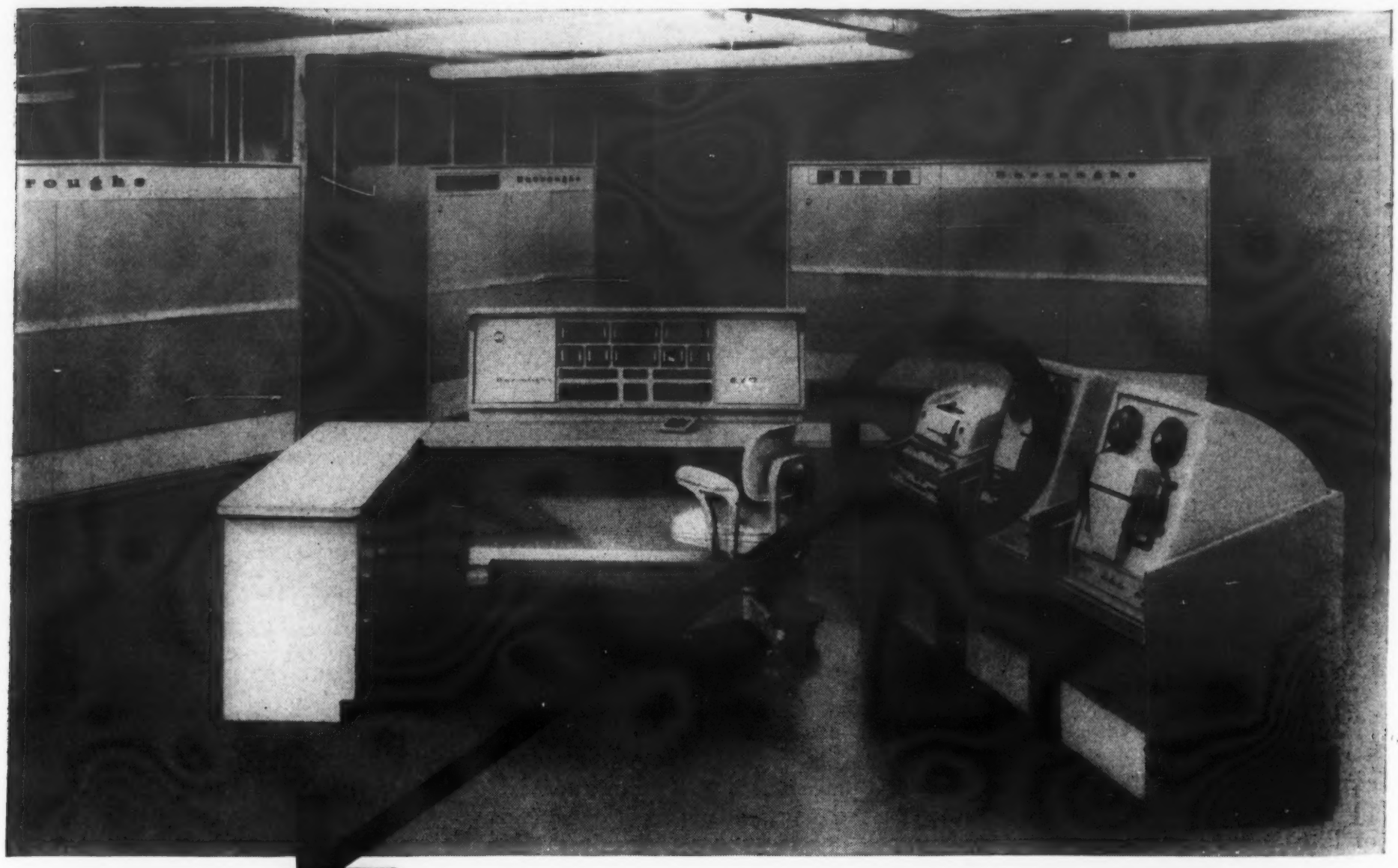
For highly technical reasons it was evident that if research and development were to proceed under the limitations of our relatively crude early warning techniques using the long (meter) wavelengths, the attainment of any of these essential fighting aids would be frustratingly prolonged.

What was needed were many short wavelengths (microwaves), with their, then only little more than academically known, very considerable advantages. If this problem could be solved, their operational advantages would offer considerable promise of fulfilling our urgent needs.

In relation to the intensive research and development which took place during the war in both our countries, comparatively little had been done in the microwave field before then. Due to a small group of scientists, such as the Varian brothers, due to their imaginative thinking, their inspiration and curiosity and their untiring research and experimentation, bombing and air fighting efficiencies of the Royal Air Force and the United States Air Force, were eventually so immeasurably superior that our allied air power was a decisively overwhelming factor in terminating the war.

I think it can be stated irrefutably that our technological achievements in the fields of radar and radio microwaves had a decisive effect in assuring Britain's air superiority and our combined victory. It is reliably stated by Dr. F. E. Terman, Provost Marshal of Stanford University, that "After the klystron became operational, it went on to become an essential part of every microwave radar that was used in World War II. These were the radars that were used for the bombing of Germany, through clouds and darkness. They were the radars that, as the war progressed, reduced the German air force to impotency and which shot down the buzz bombs. The microwave radars carried in patrol planes were in a large measure responsible for the elimination of the German U-boat menace, and such radars had an important part in the naval and air warfare in the Pacific."

(*Continued on page* 35)



Eight reasons why Burroughs chose Teletype Printer for the new 220

ElectroData Division of Burroughs Corporation made extensive tests and comparisons before choosing a supervisory and off-line printer for their new, high-speed electronic data processing system—the Burroughs 220.

Here are the eight reasons for choosing the Teletype Model 28 Printer:

1 Reliability. In actual test, the Teletype Model 28 Printer ran continuously . . . more than 20 times as long as other equipment tested.

2 Parallel Input. The Printer accepts parallel input information—desirable since the output from the data-processor is parallel.

3 Coding Flexibility. Type boxes used in the Model 28 Printer may be interchanged quickly and easily to suit a variety of code requirements. This feature is unique with Teletype.

Any code may be made to accomplish any non-printing function in the printer or to actuate a transfer contact—by a simple change in the Stunt Box (exclusive with Teletype).

4 Speed. The Model 28 Printer meets the speed requirement of 100 words per minute.

5 Readability. Quick reading of the copy is easier because type box moves across a stationary platen—rests out of the way between characters.

6 Tabulating. The Printer is equipped with a horizontal tab which is fast and adjustable. It has, also, an adjustable "Form-Out" for indexing printing on next printed form.

7 Appearance. The Teletype Model 28 Printer is housed in a well-designed, attractive cabinet.

8 Quiet Operation. Operating noises are reduced to a minimum by the sound absorbing cabinet enclosure.

More Information. The Model 28 Printer is one of several units in the all-new Model 28 line of Teletype equipment. If you would like more information on these new units, write to Teletype Corporation, Dept. 73-B, 4100 Fullerton Avenue, Chicago 39, Illinois.

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CERAMICS CREATES A MARKET



Machining Dept.—Saxonburg Ceramics

by Stanley R. March
Director of Information Services, Board of Public Education
Pittsburgh Public Schools

THE QUAINT European-type town of Saxonburg, forty miles north of Pittsburgh, is the setting of a re-enactment of an industrial saga which began more than 125 years ago. At that time a German immigrant named John Roebling began manufacturing wire cable which he hoped could be used to support the bridges spanning America's mightiest rivers. It was here that the first wire rope in this country was made in 1841. At the height of Roebling's operation, nearly the entire working population of Saxonburg worked for him.

Influenced by Peter Cooper, the eastern locomotive and iron rail builder, and by access to better transportation, Roébling moved to Trenton, New Jersey, leaving Saxonburg much as he found it in 1832 except for a row of solidly built tree-hewn homes along a shaded main street. Manufacturing was gone, and the families who remained took up farming and trading.

Born to one of the remaining farming couples in 1899 was a son, George Aderhold. Young Aderhold learned to read before he attended school. He had few companions but he devoured all the books he could borrow from family friends. At ten years of age he built a kiln to bake clay into useable receptacles. His mother who had a fascination for science and technology encouraged him. He began to dream of establishing another manufacturing plant in Saxonburg like Roebling had some 75 years before. During his four years at Butler (Pa.) High School he continued to mold and bake ceramic objects and one kiln led to a larger more improved one while he worked during the day and went to Carnegie Tech in Pittsburgh at night. After eight years at various jobs in cement plants and steel mills, he received his degree from Carnegie Tech in 1923. By this time he had become Chief Chemist of a cement works, but his nights and Sundays were consumed making ceramic objects which he hoped would have some commercial value.

In 1924 he quit his cement plant job and without an order he devoted fulltime to his first love—molding and baking ceramics in a small outbuilding just off the main street of Saxonburg. At that time schools and industries were using casseroles, crucibles and evaporating dishes in their laboratories, and he thought he could make them as good, if not better and cheaper, than anyone else. His methods proved him correct as attested by early orders he obtained from nearby Butler High School and far-off Harvard University.

The vast development of heavy industry in Western Pennsylvania and nearby Ohio runs almost parallel with the area's demand for ceramic products. Unlike John Roebling, ceramist George Aderhold was in the right place with the right product and he had the intestinal fortitude to stick to his kilns. Saxonburg Ceramics, Inc., which was officially founded in 1924, ceased to be a hobby then and it has flourished with the steadily increasing demand for its products for industrial use. The great electrical, glass and steel plants in Pittsburgh became regular customers.

During the struggling 1930's Aderhold narrowly missed giving up his dream and going back to work for one of his former employers. But really his enthusiasm for the ceramic business and confidence that he could do things better and less expensively kept him working almost around the clock. With the help of an understanding wife who managed the office while he ran the small plant and acted as salesman, he kept going. These were not easy years but they were fruitful ones. Aderhold developed new and improved methods and a variety of experimental products. As business improved, he plowed a high percentage of profits back into manufacturing. He continued to live modestly within 20 yards of the plant and he kept a constant eye on its operation.

Without ever going into serious debt, Saxonburg Ceramics, Inc., prospered under George Aderhold's frugal management. In 1958 its business volume was more than 10% ahead of 1957, and its picturesque plant is valued at nearly $800,000. The range of its products numbers in the thousands and they are made mostly to the specifications of its many customers.

Thus a small homemade kiln fired out of childish curiosity has grown into a modern plant consisting of 50,000 square feet and employing 165 workers—almost the entire working force of the historic town John Roebling made famous. Unlike Roebling, however, Aderhold feels no necessity to move closer to his markets. His loyal customers are all

around him and in fact in every state in the nation and in many foreign countries.

Aderhold, with the able assistance of plant superintendent John Pabst and engineer William Stetson, has added a multitude of scientific know-how to an ancient art. Although they still employ certain processes in which the "art" of the science is important—the development of zirconia oxide crucibles or nozzles with a melting point greater than 4200°F. or where normal tolerances of .005 are required—they have come a long way from the manufacturing methods of Roebling's Saxonburg days.

Saxonburg Ceramics, Inc., produces industrial parts as small as 20,000 per pound and as large as 1,000 pounds each. Besides steatite, cordierite and porcelain ceramic parts, many refactory oxide parts are molded and fired. Some of these with pertinent data about them are:

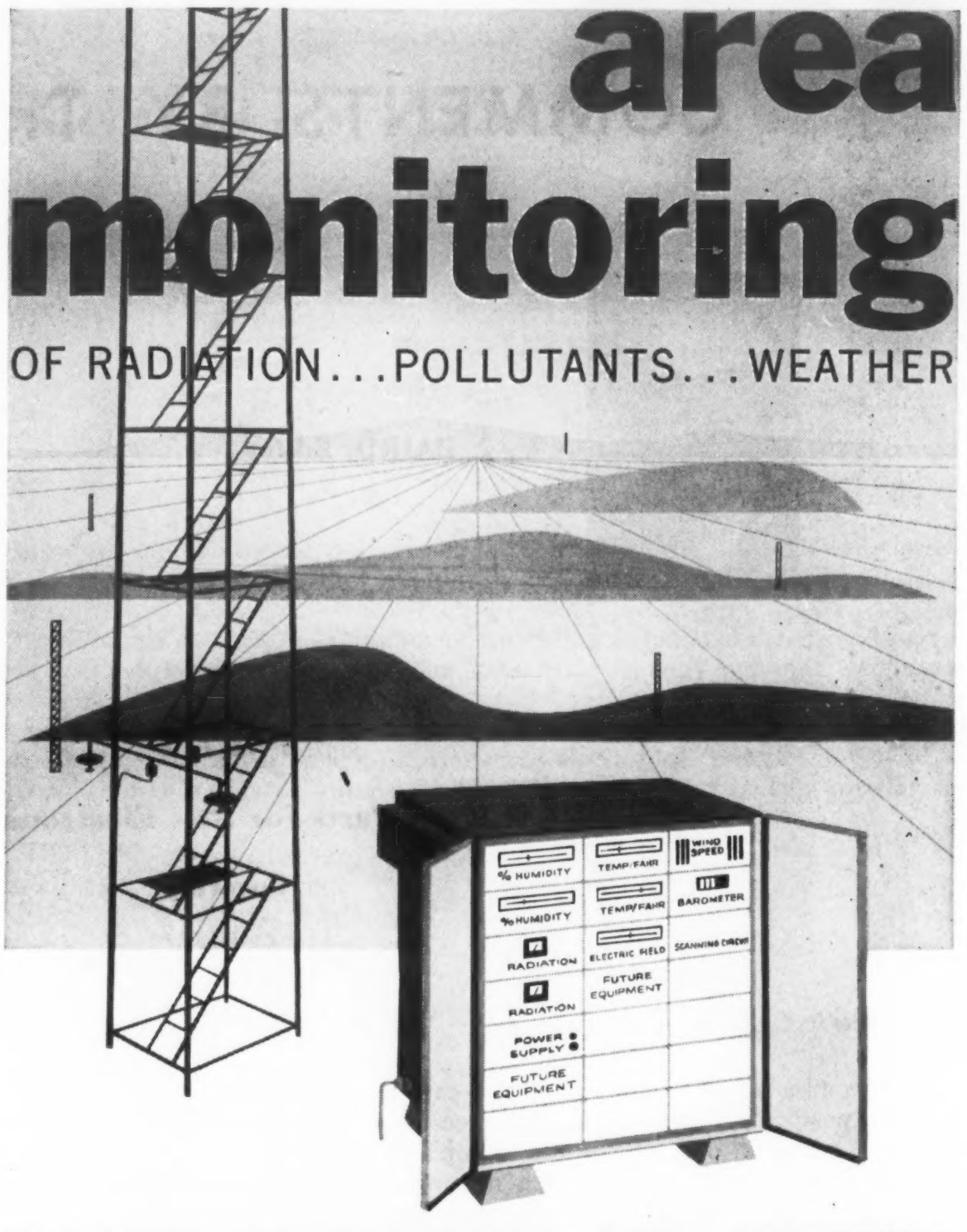
Zirconium Silicate — melting point above 3,000°F. used chiefly for combustion boats and crucibles for carbon and sulphur determination in steel mill chemical laboratories.

Zirconia Oxide—melting point greater than 4,200°F. used chiefly for pouring nozzles and crucibles.

Magnesium Oxide — melting point greater than 3,300°F. used in electronic devices, tubular hearing elements and as thermocouple insulators.

Alumina Oxide — melting point greater than 3,200°F. used as high temperature insulators and where great mechanical strength is required.

This past summer and fall has been a record season for Saxonburg Ceramics in more ways than one. Its volume remained steady in the face of declining production elsewhere, and almost more gratifying than that, the magazines of the two great Pittsburgh daily newspapers and the Pittsburgh Chamber of Commerce magazine have published glowing feature reports on its interesting operation and the products it manufactures. George Aderhold and Saxonburg Ceramics, Inc., is now completing a 8,000 square foot addition in the interest of better and less expensive service. The second act of an industrial saga is being written in Saxonburg, Pennsylvania, but it appears that George Aderhold and his ceramic plant are stars this time. Saxonburg Ceramics, Inc., is there to stay!



ELECTRO-SPAN DIGITAL DATA SYSTEMS

Wherever data must be gathered from numerous unmanned locations and supplied to a central station with extreme accuracy and speed, the Bendix-Pacific Electro-Span System can provide the answer. These digital data systems are in successful operation today.

As the illustration above indicates, many types of information can be measured and reported from remote points, such as radiation, electric field intensity, temperature, wind, humidity and the presence of numerous pollutants.

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COMMENTS BY THE EDITOR ON



W. J. BAIRD, Editor

Orders for your extra copies of the March issue of SIGNAL *featuring Components, in five parts, as well as other outstanding feature articles should be sent to* SIGNAL, *1624 Eye Street, N.W., Washington 6, D. C. by February 23 to guarantee delivery.*

Synopsis

PART I

New Parts for New Electronics

Covering

Ferrites ***Relays and High Speed Switches***

Piezoelectric Ceramic I. F. Filters ***Resistors and Capacitors*** ***Plastic Antenna Dishes and Masts***

In the area of electronic parts there can be something "new under the sun." Electronic parts have just begun to take on a posture of profound significance through progressive refinement and design. The end is not in sight.

Work going on presently in the nation's laboratories indicates whole new areas of electronic parts are just around the corner. Each new part means a new or improved capability for equipment and system designers. For example: The Army has recently developed a new family of low cost mass producible resistors of the deposited carbon type. Another recently developed family of resistors is the precision metal film type to replace most of the wire-wound resistors in future application. Just one inch of the wire from the wire-wound unit would make well over one hundred of the new precision resistors with absolutely no compromise of reliability or performance, reflecting savings of millions of procurement dollars.

You will want to read this chapter for the full story on this as well as for other interesting facts based on recent research in the fields of semiconductors and ferromagnetics.

PART II

Miniature—Sub-Miniature—Micro-Miniature

Covering

Miniature Components ***Printed Circuit Techniques*** ***Micro-Modularization***

Foremost in the minds of those connected with the design of electronic equipment is the idea to "make it smaller," "make it lighter," "make it better." In fact this is the theme song and unbending philosophy of today's military electronics designer where size, weight and reliability are the critical elements in his trade.

Micro-modules promise to reduce the massiveness of the military's new electronics by a factor of ten, contribute superior performance and dependability because of the inherently superior shock and vibration resistance of these tiny aggregates, and reduce the growing burden of electronics by as much as fifty per cent. Within the next five years, the first significant impact of the micro-module will be felt in the Army's electronics. Using the micro-module concept, bulky fixed computers requiring racks upon racks of conventional assemblies can be reduced to readily portable units.

In the communications industry an experimental micro-miniature decoder for a million-subscriber paging system is under development; this decoder occupies less volume than a package of ordinary cigarettes.

These are some of the facts which are brought to the reader's attention in this chapter.

ONSPECIAL COMPONENTS ISSUE

PART III

Power for the Future

Covering

Missile Power

Satellite Power

Man-pack Power Sources

New Concepts

Rotating generators and mechanical vibrators in mobile and portable equipments (at least in the lower classes) are now in the first stages of obsolescence. In the decade ahead, they should be replaced by non-radiating packages of stored energy.

This chapter takes a look at the exacting demands of electronic equipment which has stimulated extensive progress in power supply facilities. This progress has resulted in smaller batteries that have high capacity per unit weight and volume as well as improved storage and low temperature characteristics.

Since new energy converters will play an increasingly important role in supply energy in future Army electronic applications, this subject is covered to arouse the interest of our communications and electronics readers.

You will be interested in the remarks on the power supply of missiles and satellites and new concepts treating nuclear and solar power in the scheme of things to come.

PART IV

From Micro-watts to Mega-watts

Covering

Tube Development

Transistor Development

Transistor Applications

High Power Tubes

Masers

Time spent in reading the facts revealed in this chapter to support the following conclusions will be repaid many fold.

- Electron devices have progressed from simple three element tubes about 50 years ago to complex solid-state masers today.
- The power handling capabilities run the gamut from micro-watts to mega-watts in our military equipment.
- The further expansion of the arts and sciences of handling the electron for ultimate use in building our military capabilities for preservation and for our everyday comfort appears limitless.

PART V

Today's Research for Tomorrow's Components

Covering

Instrumentation Techniques

Molecular Engineering

High Pressure Phenomena

Pure Material Research

Radiation Effects

Strategic Material Research

Stressing research as a necessity for tomorrow's components, this chapter provides much factual data for future thought. The type of research relates to the dependence upon the creative thinker, his tools and his techniques for bringing into being new materials and the understanding of basic phenomena which are vital to our future technological progress in electronics as well as in the other scientific fields.

Research is synonymous with progress . . . and to the military today, progress means survival. The chapter does not lose sight of the fact that the intelligent application of modern instrumentation and newer techniques it generates is rapidly expanding the useful knowledge of natural composition, structure and physical properties of matter . . . the first basic step toward meaningful improvement in military capabilities.



— GOVERNMENT —

IBDL U. S. Army air defense sites protecting the New York City area are now electronically coordinated by a system called Interim Battery Data Link, or IBDL. Manufactured by The Martin Company of Orlando, Fla. in conjunction with the Army Signal Corps, the IBDL links each NIKE guided missile battery in New York City air defense system. The IBDL equipment will become part of and be replaced by the MISSILE MASTER system, also manufactured by The Martin Company, when accessory building and other preparations are complete.

CONVERT TO ALL-UHF TV? FCC Commissioner Frederick W. Ford has suggested it might be better to abandon VHF television channels and switch entirely to UHF television channels. Most viewers now see VHF broadcasts on 13 allocated channels. Additional VHF stations would interfere with existing broadcasters. By using UHF, which has 70 available channels and is somewhat less powerful, giving less geographic coverage than VHF, more stations would be allowed to come on the air. Should the FCC decide on an all-UHF system, Mr. Ford said the transition should be gradual—possibly over 7 or 8 years—the period manufacturers figure consumers keep one set before buying another.

WRIGHT-PATTERSON AFB, OHIO Brig. Gen. B. H. Warren, Commander of the Air Force's Aeronautical Systems Center, has announced the formation of a new weapon system project office (WSPO), the AEW&C (Airborne Early Warning and Control) WSPO. The new office will handle procurement, production, supply and maintenance on a soon-to-be-chosen radar warning aircraft. Lt. Col. Kermit E. Beary, formerly technical executive in the B-52 WSPO, has been appointed chief of the new project office.

CONTRACTS: ARMY: Stewart-Warner Electronics Div., 684 radio teletypewriter sets and associated items, $1,997,879; RCA Labs., extended research work on investigation of molecular amplifiers and oscillators, $99,986; Telecomputing Corp., data processing services at Holloman Air Base branch of the White Sands Missile Range, $2,816,828; Hoffman Electronics Corp., production of solar energy converters, $500,000; Raytheon Manufacturing Co., production of the HAWK missile and ground support equipment, $35,500,000. NAVY: Motorola, Inc., development of an improved guidance unit for the SIDEWINDER air-to-air missile, $1,086,000; Collins Radio Co., high density microwave system to be used at the U. S. Pacific Missile Range, $2,000,000; Sikorsky Aircraft Div. of United Aircraft Corp., production of new HSS-2 helicopters, $17,000,000; Philco Corp., continued research and development of improvements for the SIDEWINDER, $1,000,000. AIR FORCE: Crosley Div., Avco Manufacturing Corp., production of a new type of Command Receiver for range safety application by the Air Force's Ballistic Missile Division, approximately $1,000,000; Westinghouse Electric Corp., build additional terminal guidance systems for the BOMARC area defense missile, $10,000,000; Burroughs Corp., computers for Atlas ICBM program, $22,448,558.

— INDUSTRY —

A GROUND WEATHER RADAR SYSTEM said to enable TV stations to televise storms approaching from up to 150 miles away, has been developed by Radio Corp. of America. Through the use of a standard studio vidicon film camera, the radar scope presentation of a storm may be transmitted to the TV station's viewers, with the radar "picture" superimposed on a map of the area. The radar operates in the 5.5 cm C-band for the best penetration characteristics.

DAGE TELEVISION DIVISION, Thompson Ramo Wooldridge, Inc., Michigan City, Ind. has developed a completely transistorized ruggedized military television system, "MTS-4 System," which makes possible the use of closed-circuit TV within military aircraft, ships and vehicles to reliably observe and transmit visual data to one or more monitors. The entire system weighs only 55 pounds and consists of 3 components: a television camera unit, a television control unit, which provides power and synchronization to both camera and monitor and a television monitor unit.

AN ELECTRONICALLY-CONTROLLED SYSTEM said to completely stabilize generation of electrical power at constant frequencies has been developed by The Siegler Corp. of Los Angeles. This new device, known as a variable speed constant frequency alternator or the Hallamore Alternator, offers a solution to a major existing problem in everything from jet aircraft to utility power plants, at less expense and at about 1/3 less weight of present systems.

COMMUNICATIONS PACT General Precision Laboratory, Inc., Pleasantville, N. Y., and Tele-Signal Corporation, Glen Cove, N. Y., have made a five-year reciprocal licensing agreement. GPL will make its extensive engineering, production and marketing facilities available for Tele-Signal products. Tele-Signal will retain design and engineering responsibilities for its communications equipment as well as continue its present sales and pilot manufacturing efforts.

NEW RESEARCH CENTER Lockheed Aircraft Corporation, California Division, has purchased a 198-acre site near Saugus, Calif., for a multi-million dollar advanced scientific research center. The Lockheed Research Center will include a $5 million supersonic wind tunnel and high-altitude environmental test facilities for exploring problems of flight up to 10 times the speed of sound and at altitudes where man has never flown.

FOUR DIFFERENT FM RADIO PROGRAMS can be broadcast simultaneously from one antenna by new transmitting equipment built and installed at Sandale, England by Standard Telephones and Cables, Ltd., an affiliate of ITT. The BBC Sandale station transmitting equipment is part of an over-all construction and installation job involving 32 10-kilowatt and 6 1-kilowatt FM transmitters at 6 locations in England and Scotland. A feature of the STC installations is that multiple transmitters, working in parallel and phased into the antenna, are provided for each program to ensure higher reliability of service.

THE 1958 EDITION OF "THE WORLD'S TELEPHONES" released by American Telephone & Telegraph Co. shows an increase of 7,800,000 telephones during 1958. The United States, with 63,620,900 telephones, accounted for more than half of the total number of telephones in the world and led the list of countries having the largest systems. Next was the United Kingdom–7,354,000; Canada–4,816,118; the German Federal Republic (West Germany)–4,731,945; Japan–3,886,327, and U.S.S.R.-3,558,000.

— GENERAL —

ELECTRONIC RESTAURANT A fully electronic restaurant which automatically carries on such functions as cooking, serving, washing, cleaning and payment is now in the engineering stage at Designers for Industry, Cleveland, Ohio. All food is placed automatically on individual place settings which are mounted on round tables which revolve through the side walls of the restaurant. "Chairs" without legs are mounted on the side wall, in the form of curving, self-supporting benches which swing around the table. The customer selects his menu from a push button electronic selector panel. When his order is completed, the table revolves in a 180 degree arc, and his menu is before him, along with a printed bill. This electronic unit requires but one employee per 32 place settings.

THE SIXTH ANNUAL AMATEUR RTTY DINNER will be held during the IRE National Convention in New York City on March 23, 1959. Technical discussions and demonstrations of teleprinter equipment are planned. Reservations must be made in advance by contacting: Clay Cool, W2EBZ, 445 West 47 St., N. Y. 36, N. Y.

THE EIGHTH ANNUAL SINGLE SIDEBAND DINNER AND HAMFEST, sponsored by the SSB Amateur Radio Association, will be held on Tuesday, March 24, 7:30 PM at the Hotel Statler Hilton, 33rd St. and 7th Ave., N.Y.C. All amateurs and their friends are invited to attend this dinner. Bill Leonard, W2SKE, will be master of ceremonies. Tickets purchased in advance are $8.00 each and $9.00 at the door. Send reservation requests to SSBARA c/o Irv Binger, W2CMM, 1741 Andrews Ave., N.Y. 53, N.Y.

CALENDAR OF EVENTS:

MARCH 2-4: The Fifth Annual Electronics Conference of the American Management Association is to be held at the Statler-Hilton Hotel, New York. The role of the electronic computer in industry will be re-evaluated, and timely topics will be discussed. Electronic data processing equipment will be on display.

MARCH 3-5: The 1959 Western Joint Computer Conference will have its headquarters at the Fairmont Hotel, San Francisco and is jointly sponsored by the IRE, AIEE and the Association for Computing Machinery. The conference theme is "New Horizons with Computer Technology."

MARCH 23-26: The 1959 IRE National Convention is to be held at the Waldorf Astoria Hotel and New York Coliseum in New York City. On Tuesday evening, March 24, Eric A. Walker, President of Pennsylvania State University, and a panel of leading experts will conduct a special symposium on "Future Developments in Space."

the army signal board

by Robert B. Kimble, Project Officer, U. S. Army Signal Board
Ft. Monmouth, N. J.

THE ARMY SIGNAL Board appears to the casual observer as an assembly place for consultants who occupy a group of small offices clustered on the top floor of the Headquarters Building at Fort Monmouth, New Jersey. Within these confines there is continuous, quiet movement of both uniformed and tweeded men exchanging ideas, convening for conferences, carrying charts to briefings, or simply pursuing doggedly a train of facts that may lead them from the Board's own records to any one of the far-flung military agencies, universities, or industrial contractors who are concerned in any way with military applications of electronics. These men make up the Board's professional staff, a group of about twenty military and civilian project officers—each a specialist in a particular field—who perform the basic analysis on all problems referred to the Board.

Established in 1924, the Army Signal Board is an agency of the Chief Signal Officer. It is his principal consultative body, designed to provide him with the consolidated position of his senior commanders on any matter of concern. The Board has always maintained a dual concern for the pressing problems of today and the potential problems of the future. Its membership is made up of the commanding generals of all activities under the control of the Chief Signal Officer, as well as a carefully selected group of senior field-grade officers chosen to serve full-time with the Board's staff. The Board's professional staff was created to provide the members of the Board with the sifted and evaluated facts they need in order to take informed positions.

For the last five years the Board has been significantly concerned with the role of electronics in future Army operations. Mounting technological advances, together with the need for wholesale revamping of tactical concepts, have generated a requirement for recurring close scrutiny of basic assumptions and principles. The Board's principal belief is that military signaling, relying heavily upon electronics, is to an unprecedented degree the key to success in modern war. The function of military signaling derives from the basic military need to supplement human capabilities of communication and perception. Military signaling consists of the systematic employment of devices designed to acquire and transmit information essential to the command and control of our own forces, and to counteract the effectiveness of similar efforts by the enemy. It is to the analysis of the policy and doctrinal implications of the growing potential of military signaling that the Board has turned more and more frequently.

The Board might be expected, for example, to make a recommendation on the probable nature of military signaling in the 1975-80 period, on the text of a briefing by the Chief Signal Officer to the General Staff or on the developmental outlook of a device not yet in the design stage.

The range of this interest has been broadened in the thirty-four years of the Board's existence by the courtship and marriage of military science and technology. First radar, then the VT fuse, and since the A-bomb the revolution in warfare and its consuming appetite for faster and faster integration of new advances in weaponry, have steadily expanded the applications — and the problems — of electronics with such growing acceleration that to speculate on the picture ten years hence is to risk intellectual bends.

The Board's activities in the early twenties were unhurried and unpressed. The members convened only at the call of the President. By 1930, however, the tempo had picked up enough for the Chief Signal Officer to assign an officer to full-time duty with the Board as its Secretary. And the Board quickly became "the most important of all the committees and boards at the disposal of the Chief Signal Officer."

It is sometimes difficult to assess accurately the ramifications of the Board's recommendations. There are, however, numerous instances of an unclassified nature in which its recommendations produced observable results. Board Case 13 in 1925 resulted in the creation of the Military Affiliate Radio System (MARS). Case 163 (1931) resulted in the creation of Military Occupational Specialties (MOS) which set forth precise standards for signalmen. Case 312 (1939-40) was an evaluation of the potentialities of Radio Set SCR-270, which became the basic early-warning radar used by the Army prior to and during the early phases of World War II. The Board's demonstration of this set for Secretary of War Woodring, the Army Chief of Staff General George C. Marshall, the Chief of the Army Air Corps, and the Chief of Coast Artillery, resulted in $9 million—which was then considered a spectacular sum—being allocated for an aircraft-detection program. This was the first major high-level recognition of the signal research-and-development program at Fort Monmouth.

Following the Third Army "Louisiana" Maneuvers in 1940 which revealed unmistakably the woeful inadequacy of the Army's signal capabilities, the Chief Signal Officer knew that questions would be asked and answers would be required on future signal personnel mobilization objec-

tives. There had long been a serious dearth of trained signalmen and the Army's heavy reliance on commercial facilities was the cause responsible for its inability to field an effective signal capability. Consequently, the Signal Board was instructed to be ready with the answers, especially in light of the Army's anticipation of Congressional action to expand the military manpower figure to create new tactical and service units. Such Board members as Olmstead, Ingles, Milliken and Back, soon to become general officers and all of whom except Milliken later became Chief Signal Officers, resolved the personnel requirements in a matter of 5 weeks. Their action provided a sound basis for a mobilization plan and substantially improved the signal equipment problem.

General Ingles, after he became Chief Signal Officer, attempted to direct the Board's attention more closely to the tactical, in contrast to the technical. But the press of equipment problems, confronting him as a key figure in the Army Services Forces, tended persistently to isolate him from operational considerations. The Board's activities, ever sensitive to the directions of the Chief Signal Officer's efforts, reflected this situation and it was not until 1949 that the Board was able to concentrate a significant portion of its efforts on tactical matters. Lt. Gen. James D. O'Connell, the present Chief Signal Officer, came to the Board during this period to serve as its Deputy President. The Board plunged into a wholesale investigation of helicopter potentials, field army antiaircraft radio plans, logistical organization, electronic countermeasures and counter-countermeasures, communications-electronics requirements for guided missiles, and tactical television, in addition to an evaluation of the Chief Signal Officer's mobilization policies. Tactical matters continued to constitute a substantial portion of the problems referred to the Board throughout the Korean War.

By 1954 General Back, then Chief Signal Officer, found it necessary to direct the Board's attention to problems engendered by the reorganization program of the Army and related high-priority projects. The Board thus entered a new 5-year phase characterized initially by a broad investigation of (1) the adequacy and effectiveness of signal doctrine, theater signal organization, signal equipment programs, and signal supply and maintenance systems, and (2) the effect of new weapon systems and concepts on future signal operations.

Proceeding from the concrete accomplishments in these five major areas, the Chief Signal Officer directed the Board to take a broad, overall look at his current area of responsibility from the viewpoint of long-range objectives. Included within this general investigation was a systematic analysis of the roles of the Chief Signal Officer and the Signal Corps in National security.

The importance of the Chief Signal Officer's being able to obtain timely advice which reflects not only sober analysis, but also the combined opinions of the commanding generals of the various Army signal agencies is obvious. But essential to the value of this advice is the Board's ability to respond quickly to the Chief Signal Officer's problems, its ability to cope with the diverse nature of his problems, and the fact that its recommendations are expressed in a qualitative way, readily applicable to the complex coordination of all those efforts aimed at providing, through military signaling, optimum command control for the Army.

Klystron—The Creative Core

(*Continued from page 26*)

Dr. Russell Varian, Sigurd Varian and their associates are typical in their American generosity. I am reliably informed that they came to Stanford early in 1937 with the specific objective of developing a high powered microwave radar tube to meet the immediate need of limiting our common enemy's capabilities. They were among the early few whose loyalty and cooperative spirit, along with the close liaison between the military services and radar scientists and engineers of our two countries, led to the most cordial and productive results. Dr. Lee A. Du Bridge has said, "The importance of the contacts between our two countries was dramatically illustrated as early as June of 1941, when a model of the Radiation Laboratory's A.I. (Air Interception) equipment was installed in an airplane supplied by the Royal Canadian Air Force and sent to England, accompanied by Dr. D. R. Corson, for technical and operational trials. I am sure you would like to know that your President, H. Myrl Stearns, was project engineer for this equipment. These trials showed the American equipment to be inferior in performance to the British equipment as far as receiver techniques were concerned, but they also showed that the American transmitting equipment was more powerful than the British. By combining the best features of British and American sets, a set which outperformed either was put together."

It would require considerable time even to list the numerous other examples of a fruitful outcome of British and American collaboration.

"Engineers and scientists have wanted to use higher frequency signals for a number of reasons. Since the ordinary vacuum triode could not fulfill these needs without introducing unconquerable problems, these men sought other means of amplifying, oscillating and multiplying their high frequency signals. Out of this search came the idea of velocity-modulated tubes, of which the klystron is an important type."

The Varian brothers were in the forefront of the tremendous research and development effort that went into the development of radar and related techniques during World War II and that resulted not only in thousands of radar sets for military and peacetime use, but also in a great body of information and new techniques in the electronics and high frequency fields.

From the invention of the original klystron the principle of the tube has been expanded and has become the creative core of our combined military defense and offense weapons systems. To this end this brother team has devoted a substantial portion of the growth funds of their company to research and development of military weapons for the North Atlantic Treaty Organization.

Due to the boldness of their approach and the clarity of their understanding, the Varian brothers and their collaborators—by their introduction of the klystron—deserve to be considered the founders of microwave electronics.

I have tried to acknowledge some of the splendid achievements of Dr. Russell Varian and his brother Sigurd Varian. Both in the field of electronic research and in the electronic industry, their outstanding contributions to the scientific prestige and industrial progress of the United States deserve our highest esteem and our warmest congratulations. On behalf of the Royal Air Force, I wish to express our sincere gratitude for their contributions and those of their associates.

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FREQUENCY SHIFT TONE KEYER—Type 211 Model 1

Keying inputs, levels & impedances: 1. Contact keying (internal battery to "dry" contacts) 1 ma. min.; 2. DC current pulses, positive or negative, neutral or polar, high range, 220 ohms, 30 ma. min. low range, 2200 ohms, 0.5 ma. min.; 3. DC voltage pulses, positive or negative, neutral or polar, high range, 100,000 ohms, 10 volts min., low range, 2200 ohms, 1 volt minimum.

Frequency Stability: Standard Networks ±2 cps total for all causes including ±10% line voltage change and ±25°C. from 25°C. temperature change.

Harmonic Content: All harmonics of the tone are more than 50 db below output level.

Output Frequencies: All standard VF carrier channels from 425 to 3315 cps. Bandwidth dependent on keying speed requirements. Other frequencies and bandwidths available on special order.

Output Level & Impedance: 5 dbm maximum, into 600 ohms, unbalanced. May be paralleled with any number of other Keyers operating on different frequencies in the same audio system.

Power Requirements: 14 V DC, 15 MA. Two transistorized power supplies and one automatic change-over relay are mounted on the rear of each mounting shelf.

Dimensions: ⅞" wide x 5¼" high x 10½" deep.

FREQUENCY SHIFT TONE CONVERTER—Type 212 Model 1

Input Level & Impedance: —48 dbm to +8 dbm into 600 ohms, unbalanced. May be paralleled with any number of other converters operating on different frequencies in the same audio system.

Input Frequencies: All standard telegraph VF channels from 425 to 3315 cps. Bandwidth dependent on keying speed requirements. Other frequencies and bandwidths available on special order.

Output: Neutral DC voltage pulses of 10 volts maximum across a 2000 ohm external load. Polar pulses ±10 volts across a 2000 ohm external load. Output drives appropriate voltage-to-current converters, such as Northern Radio Type 213 Transistor Relay, which provides proper teleprinter operating currents. Printers which are already equipped with internal repeating relays may be driven directly from the normal output terminals of the Type 212 Converter when so desired.

Power Requirements: 14 V DC at 30 MA. Two transistorized power supplies and one automatic change-over relay are mounted on the rear of each mounting shelf.

Dimensions: 1⅞" x 5¼" x 11¾" deep. For rack mounting a number of these units, a shelf assembly is available accommodating nine (9) units in a panel height of 5¼".

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research on detection of non-metallic mines



FIGURE 1

by Chandler Stewart, U. S. Army Engineer Research & Development Labs.

There are probably few single research objectives which involve investigations into so many branches of science as does the mine detection program of the U. S. Army Engineer Research and Development Laboratories, (USAERDL), Fort Belvoir, Va.

Studies are being conducted, both at Fort Belvoir and by contractors, in acoustics, chemistry, biology, electronics, geophysics, atomic physics, magnetism, seismology, antenna design, microwave scattering, infra red radiation, nucleonics, radiology, information theory, statistics and signal analysis.

All of this is to find out what physical reactions and apparatus design will yield the greatest contrast between responses to buried land mines and interfering responses from soil, rocks, vegetation, etc. The problem is especially challenging as all of the information needed to evaluate a proposed reaction and apparatus does not normally exist within the available scientific literature and "state of the art." As a result, basic research into unexplored areas is required.

Some Unusual Problems

For example, the general requirements for the shape of the optimum coupled electric field in the soil for detecting dielectric variations is known but the design formulas for antennas to produce this field are not available. Existing antenna design theory is of no use here because it is based on the objective of optimizing the field strengths at a large distance, for communications and radar applications, without regard to the "near zone" field characteristics.

Most of the vast amount of information theory and signal improvement devices which have been developed recently are not useable for mine detection because the assumed signal and noise characteristics are those commonly encountered in communications and radar. Mine signals are quite different from radar target signals and soil noise is so similar to the mine signals that separating them becomes an especially challenging problem in information theory.

An example of research requiring the coordinated efforts of a scientific team is the search for an understanding of the mechanism whereby dogs are sometimes able to find mines. The experimental conditions must be supervised by psychologists, the desensitizing of the dog's olfactory nerves and measurements of his responses to stimuli must be carried out by a physiologist and the measurement of gas emanations from the mine planting operations must be done by a chemist. Because of the extremely low concentration of these gases, the most sensitive apparatus must be employed—apparatus such as microwave resonance or mass spectrographs, which requires the attention of an electronic technician to assure its proper operation.

Special Research Facilities

Much of the experimental facilities for mine detection research has been specially developed by scientists at Fort Belvoir for needs that could not be filled by commercially available instruments and apparatus.

One important specialized facility is a test mine field completely housed consisting of six soil lanes containing various inert non-metallic antitank and anti-personnel mines and mine fuzes. Each lane contains a different type of soil—clay, magnetic iron oxide, dry sand, wet sand, gravel and loam. An overhead carriage, supporting the specimen search head or detection device under test, covers each pair of lanes. The carriage moves automatically by compressed air drive to avoid the interfering electric and magnetic fields of electric motors. There is a separate inclosed instrument room from which the operator can control and observe the carriage movements. Figure 1 is an internal view of one end of this room. It contains recorders, which are synchronized to the carriage movements so as to plot detector response versus search head position, and a specially developed analog-to-digital converter which records the responses on Univac tape to facilitate analysis by automatic computers.

Studies of the effect of antenna configuration upon the shapes of coupling fields require an absorption chamber to avoid interference from reflections from walls and objects. A specially designed cement block is used as a permanent reference standard to simulate a soil condition in comparing the performance



of mine detectors, and a specially designed test chamber for observing the effect of temperature upon detector behavior. The construction of this chamber is unique in that it avoids the use of nails or other metal parts to which the search heads are sensitive.

Consultant Services

Because this research centers about the frontiers of knowledge in the scientific areas involved, its success depends upon help and guidance from scientists having the most advanced backgrounds and capabilities that are available. Therefore, a number of expert consultants are retained to review the work in progress and advise the laboratories on ways to correct deficiencies and on new investigations to be undertaken. These consultants meet in panels, each devoted to a particular branch of science—such as magnetism, acoustics, nuclear physics, biology, electromagnetic induction and radiation and chemistry—and submit joint reports covering the decisions reached at the meetings. Also, many of the consultants undertake individual investigations in certain areas as well as assist on specific problems upon request.

This consultant program supplements the full time research of USA-ERDL and its contractors and is essential for assurance that no stone is left unturned in the search for promising physical reactions and that each is evaluated conclusively. Because of the limited availability and areas of specialty of most of the consultants, the laboratories are continually searching for additional prospects, who have an interest in this research and can make contributions.

Present Status

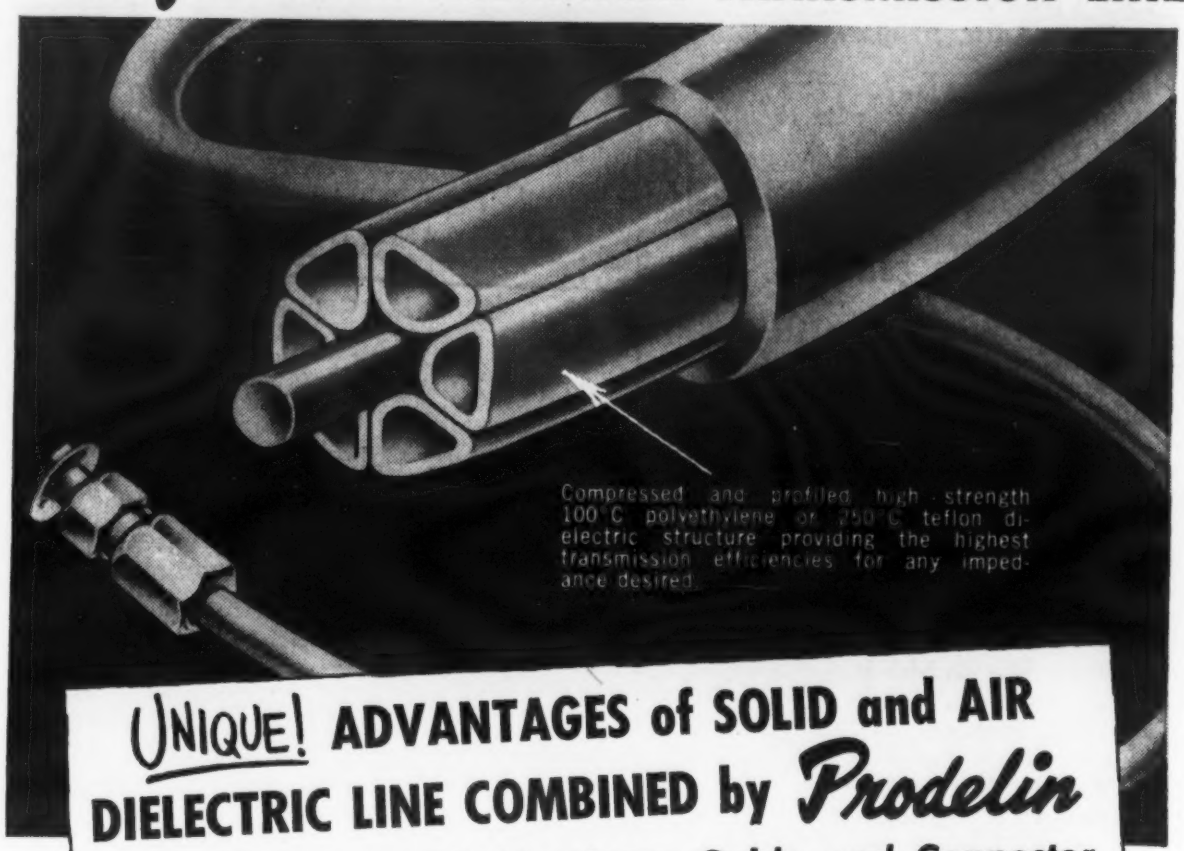
Although exact information on performance of mine detectors achieved to date carries a military security classification, it can be said that the most serious deficiency of present equipment is the high rate of false alarms. The mine detector operator, of course, cannot distinguish between a legitimate mine signal and a false alarm, which may be due to several causes, such as variations in soil moisture, density, mineral content, or contour, as well as certain types of vegetation and underground objects such as stones, tin cans, tree roots, pipes, etc. Reduction of this deficiency is the major objective of the research program.

A number of promising approaches are under investigation.

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Ten Officers Graduate With Honors

Ten officers graduating with top honors from courses offered at the U. S. Army Signal School recently were presented the AFCEA Award for outstanding scholastic achievement.

2d Lt. Peter Argetsinger, 903 B St., Juneau, Alaska, Signal Officer Basic Course, Sec. 707. Oregon State College, General Science.

2d Lt. Thomas C. Baird, 1077 9th St., Boulder, Colo., Signal Maintenance Officer Course, Sec. 3411. University of Colorado, Electrical Engineering.

2d Lt. Thomas R. Baxter, 1635 Madison Ave., Montgomery, Ala., Signal Officer Basic Course, Sec. 710. Alabama Polytechnic Institute, Mathematics.

2d Lt. Richard P. Dolan, Box 68, Davis Creek, Calif., Signal Officer Basic Course, Sec. 704. University of Santa Clara, Electrical Engineering.

2d Lt. Charles C. Joyce, 116 Spring St., Red Bank, N. J., Signal Officer Basic Course, Sec. 703. Massachusetts Institute of Technology, Electrical Engineering.

2d Lt. Jerry W. Ligon, 2605 Drummon St., Vicksburg, Miss., Signal Officer Basic Course, Sec. 709. Oregon State College, Electrical Engineering.

2d Lt. Dale I. McLean, 10 Gannett St., Augusta, Me., Signal Officer Basic Course, Sec. 708. University of Maine, Electrical Engineering.

2d Lt. Alan B. Salisbury, 459 Ridgewood Rd., Maplewood, N. J., Signal Officer Basic Course, Sec. 706. United States Military Academy, Military Science.

1st Lt. Paul C. Simms, Box 85, Dahlonega, Ga., Signal Officer Basic Course, Sec. 705. North Georgia College, Physics.

2d Lt. Fred C. Wist, P. O. Box 333, Scappoose, Ore., Communications Center Operations Course, Sec. 2314. Oregon State College, Science.

AFCEA Ham Net

The AFCEA Ham Net has attracted many SIGNAL readers since its beginning over a year ago. Members of the net are listed in more than half of the States, from New York to California and from Maine to Florida. Other operators can be found in Germany, Hawaii, Italy and Puerto Rico.

The purpose of the net is to provide radio contacts among members of AFCEA.

A complete directory of ham operators is being compiled by Ray Meyers, Region F Vice President, and will be available soon. The following call letters were received recently at National Headquarters:

New Jersey: WA2DAH, K2GX
Maryland: W3ENK, W2AOS
Virginia: W4YC4
Italy: I1AFS

AFCEA Directors To Meet

The Executive Committee and the Board of Directors will discuss Association matters at two meetings, February 12, in the Board Room of the Army-Navy Town Club, Washington, D. C. The Executive Committee will convene at 9:00 a.m. and the Board of Directors will assemble at 2:00 p.m.

March Components Issue

The March issue of SIGNAL will present a series of timely and informative articles on components entitled, "The Signal Corps Reports on Army Research in Components." Also, the issue will contain articles relating to the importance of components in industrial electronics. For a more detailed description, see pages 30 and 31. Order your copy now.



NEW AFCEA MEMBERS

Listed below are new members of the AFCEA who have joined the Association during the month of December. Members are listed under the Chapter with which they are affiliated. The January listing will appear in the March issue.

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Thomas H. Saffold
W. C. Boyd
Thorne S. Winter, Jr.
William W. Knight
Lt. Cdr. George J. Yundt, Jr.
Thomas H. Jones
Louis H. Swayze
Hal E. Solem
Robert E. Lemon
Iris W. Carmack
John Pfeiffer, Jr.
L. W. Pressley
William H. Bailey
Henry W. Barron, III
Harold Y. Couch

Augusta-Fort Gordon
2nd Lt. Stanley M. Berlin
Maj. George A. Dewey
Allen W. Wiegand

Boston
Robert E. Smith
LCdr. Fendt Langston
Charles E. Ruisi
Cornelius J. Kvasnak
Lyle J. Kaufman

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Fred Schnell

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Donald W. Sheall
Elmer J. Cerny
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Pvt. Ronnie Whiteman
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Lafayette Hannon

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E. L. Boyce

Hawaii
Capt. John E. Smith
Capt. James D. Feltman
Louis Augustine
1st Lt. Angelo Bortolutti
M-Sgt. Donald W. Black
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Sfc. Donald M. McNea
Maj. Courtleigh P. Sparks
William Duponte, Jr.
Richard H. Booth

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Lexington
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Arthur K. Bradley
P. M. Harding
Frederick H. Worth
Capt. James T. Witt
Col. Edison C. Weatherly

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Maxime J. Gonzales
Harry L. Bridges
Edward J. Shannon, Jr.
Charles J. Vaught

Montgomery
Maj. Raymond C. Toll
Charles E. York
Carl E. Henry
Herman C. Hutchison
James O. Bradshaw
Dr. Gordon G. King
Dr. Willis A. Michaels

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Edgar D. Westerfield
Raymond F. Kelley
Donald B. Nason
James A. Nottingham
1st Lt. Robert M. Sather
Capt. Joseph Fischler
Lt. Col. James H. Malone
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James F. Brady
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H. Rowley, Canada

CONVENTION NEWS

FIRST—THIS MESSAGE!

FROM THE CONVENTION CHAIRMAN,

About the 1959 Convention to be held at the Sheraton-Park Hotel, Washington, D. C., on Wednesday, Thursday and Friday, June 3, 4, and 5. 1959.

AFCEA'S Convention, the biggest single event of the Association's calendar or fiscal year, belongs to its members. They want to have QUALITY, and we of the Committee, encouraged by the proclaimed success of the 1958 Convention and Exhibit last June, are bound and determined to make it QUALITY in all respects—exhibits, panels, social events, even in the official meetings of the Association officers!

We are well on the way toward a full quota of exhibits. Will Copp, our Exhibits Manager, reports excellent progress, sparked by President Eisenhower's State of the Union Message and the rising optimism of the times. Our outstanding exhibits will be viewed from 11 a.m. to 7 p.m. on June 3 and 4; and from 11 a.m. to 5 p.m. on the last day, June 5. Still doing brisk business, Will is ready to talk turkey with interested would-be exhibitors who want their products in the limelight in the Exhibit Hall—or even just outside the hotel entrance, as was the tremendous radar antenna last year.

We plan on having six carefully chosen panels—two each day—on timely subjects, monitored by men outstanding in their fields. Each panel will present, in effect, a series of pertinent papers, and will have time at the end of its session for good spirited discussions from the floor. In this way our "Professional Papers" of the 1959 Convention will be handled. Also, this year it is the Army's turn to sponsor the popular tour, generally similar to the Navy's at the Naval Research Laboratory in 1957 and the Air Force's big show at Andrews AFB in 1958. Further, we expect to have a bigger and better Ham Station at this Convention.

Social events will be numerous and will include activities for the ladies. You can have a "whirl" or leisurely passing of time, as you wish. Don't forget the wonderful buffet of the first day, with the incomparable entertainment of John Gilbarte— this is our mammoth funfest and feed and "get-acquainted" party, to which hundreds of guests, near-AFCEANS and AFCEANS should all come. Then there will be the main banquet on the second day, with a big-name speaker to deliver a timely subject. (Remember how General Hershey took his audience by storm last June!) Don't fail to attend the Keynote Luncheon on June 3 and the Industrial Luncheon on the last day, June 5; both of these luncheons will sparkle with good speaking and good fellowship. And, on the side, we hope to be able to run in a few surprise events.

Our 1959 Convention will present an unexcelled opportunity for you and yours to meet old friends and make new ones. It's a wonderful chance to learn some new things in your trade and to have a good time, too. Remember those dates—June 3, 4 and 5—and earmark them on your various desk calendars.

Send in suggestions to our committee, already functioning:

Yours for the best Convention and Exhibit ever!
W. B. (BILL) GOULETT,
1959 Convention Chairman

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Executive Vice President
National Headquarters

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Hoffman Laboratories

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During 1958, the following firms selected SIGNAL *as the medium for their advertisements. These firms, by supporting AFCEA, are demonstrating their readiness to serve the National Security in the fields of Communications, Electronics and Photography.* SIGNAL *knows that its readers study these advertisements carefully, look forward to future messages from these firms and take action on the products and services mentioned.*

A

Admiral Corp., Government Labs. Div.
Allied Radio Corp.
American Machine & Foundry Co.
American Telephone & Telegraph Co.
Arnold Engineering Co.
Assembly Products, Inc.
Automatic Electric Co.

B

Beck's, Inc.
Bendix-Aviation Corp., Bendix-Pacific Div.
Blaw-Knox Corp.
Bomac Laboratories, Inc.
Bruno-New York Industries Corp.
Bulova Watch Co., Dept. of Government and Industry Sales
Burke & James, Inc.
Burndy Corp.
Burroughs Corp.

C

Capitol Radio Engineering Institute
Collins Radio Co.
Communications Co., Inc.
Contraves Italiana
Craig Systems, Inc.

D

Dage Electric Co.
Daystrom Inc., Instrument Div.

F

Federal Electric Corp.
Oscar Fisher Co., Inc.
Ford Instrument Co.

G

General Aniline & Film Corp.
General Electric Co., Heavy Military Electronic Equip. Dept.
General Electric Co., Light Military Electronic Equip. Dept.
General Electric Co., Technical Products Dept.
General Mills, Mechanical Div.
Grimson Color, Inc.

H

The Hallicrafters Co.
Hoffman Electronics Corp., Hoffman Laboratories Div.
Hughey & Phillips, Inc.
Hunter Manufacturing Co.
Hycon Eastern, Inc.

I

Institute of Radio Engineers
Instruments for Industry
International Resistance Co.
International Telephone & Telegraph Corp.

K

Kato Engineering Co.
D. S. Kennedy & Co.
Kleinschmidt Div., Smith-Corona Marchant, Inc.

L

Lenkurt Electric Co.

M

The Martin Co.
Microphase Corp.
"Missiles and Rockets"
Motorola, Inc.

N

Nems-Clarke Co.
North American Van Lines, Inc.

P

Page Communications Engineers, Inc.
Patent Button Co., Patwin Div.
L. A. Pereira & Co.
Philco Corp., Government & Industrial Div.
Philco Corp., Lansdale Tube Co.
Philco Corp., TechRep Div.
Polaroid Corp.
Prodelin, Inc.

R

Radiation, Inc.
Radio Corp. of America, Broadcast and Television Equip.
Radio Corp. of America, Defense Electronic Products Div.
Radio Corp. of America, Electron Tube Div.
Radio Corp. of America, Semiconductor Div.
Radio Engineering Laboratories, Inc.
Radio Engineering Products
Raytheon Manufacturing Co.
Rixon Electronics, Inc.

S

Sangamo Electric Co.
Scientific-Atlanta, Inc.
Servo Corporation of America
Sperry Rand Corp., Sperry Gyroscope Co.
Sperry Rand Corp., Sperry Semiconductor Div.
Sprague Electric Co.
Stromberg-Carlson Co.
Sylvania Electric Products, Inc., Electronic Systems Div.

T

The Technical Materiel Corp.
Telecommunications Radioelectriques et Telephoniques
Teletype Corp.
Thompson Ramo Wooldridge Inc.
Times Facsimile Corp.

U

Harry Ungarsohn
United Electronics Co.
United Transformer Corp.

W

Western Electric Co.
Westinghouse Electric Corp.

TANK TACTICS

on teletypewriter tape



Capable of reception at speeds of 750 words a minute, new Kleinschmidt unit is world's fastest message printer and code puncher

A major breakthrough in mechanical printing! Developed in cooperation with the U.S. Army Signal Corps, this new super-speed teletypewriter is ten times faster than "standard" equipment, five times faster than normal conversation. In future commercial use it could speed operations such as the transmission of telegrams, stock market quotations, and weather reports. It has important applications in the field of integrated data processing. In recognition of its quality, Kleinschmidt equipment is manufactured for the U.S. Army under the Reduced Inspection Quality Assurance Plan.

KLEINSCHMIDT

DIVISION OF SMITH-CORONA MARCHANT INC., DEERFIELD, ILLINOIS

Pioneer in teleprinted communications systems and equipment since 1911

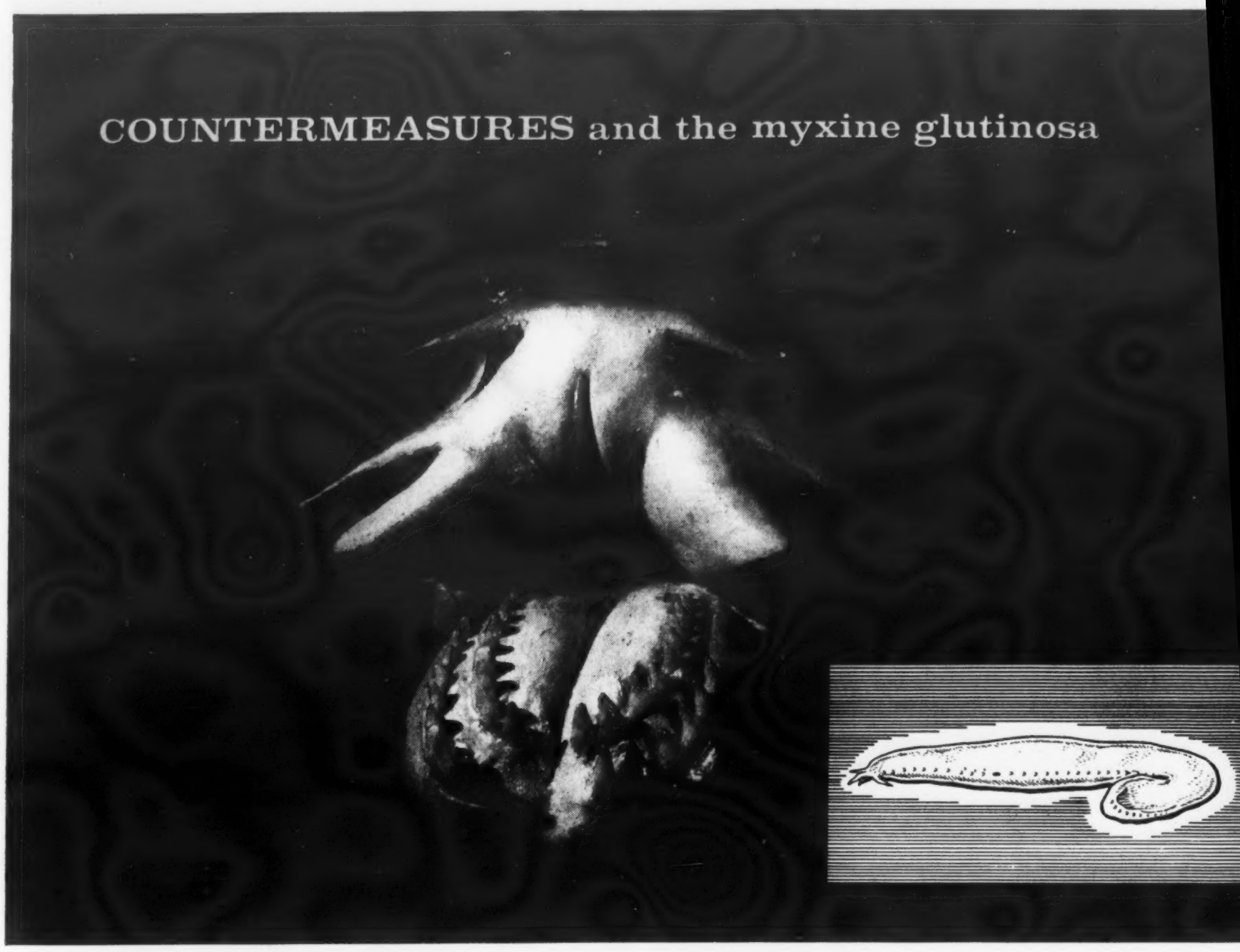
AFCEA Group Members

Communications—Electronics—Photography

Listed below are the firms who are group members of the Armed Forces Communications and Electronics Association. By their membership they indicate their readiness for their share in industry's part in national security. Each firm nominates several of its key employees or officials for individual membership in AFCEA, thus forming a group of the highest trained men in the electronics and photographic fields, available for advice and assistance to the armed services on research, development, manufacturing, procurement, and operation.

Acme-Danneman Co., Inc.
Admiral Corp.
Aircraft Radio Corp.
Allied Control Co., Inc.
Allied Radio Corp.
American Cable & Radio Corp.
American Institute of Electrical Engineers
American Machine & Foundry Co.
American Radio Relay League
American Telephone & Telegraph Co.
American Telephone & Telegraph Co., Long Lines Dept.
Ampex Corp.
Amphenol Electronics Corp.
Anaconda Wire & Cable Co.
Arnold Engineering Co.
Atlas Film Corp.
Atlas Precision Products Co.
Automatic Electric Co.
Automatic Electric Sales Corp.
Automatic Telephone & Electric Co., Ltd.
Autonetics, Division of North American Aviation, Inc.
Barry Controls, Inc.
Bell & Gossett Co.
Bell Telephone Company of Pa.
Bell Telephone Laboratories, Inc.
Bendix Radio Division, Bendix Aviation Corp.
Bliley Electric Co.
Bomac Laboratories, Inc.
British Thomson-Houston Co., Ltd.
Bruno-New York Industries Corp.
Burroughs Corp.
California Water & Telephone Co.
Cambridge Thermionic Corp.
Capitol Radio Engineering Institute, Inc.
Carolina Telephone & Telegraph Co.
Central Technical Institute
Chesapeake & Potomac Tel. Co.
Cincinnati & Suburban Bell Tel. Co.
Collins Radio Co.
Columbia Broadcasting System, Inc.
Contraves Italiana
Convair, Division of General Dynamics Corp.
Cook Electric Co.
Copperweld Steel Co.
Cornell-Dubilier Electric Corp.
A. C. Cossor Ltd.
Craig Systems, Inc.
Crosley Division-Avco Mfg. Corp.
Designers for Industry, Inc.
Diamond State Telephone Co.
Dictaphone Corp.
DuKane Corp.
Du Mont, Allen B., Laboratories, Inc.
Eastman Kodak Co.
Electronic Associates, Inc.
Electronic Communications, Inc.
Elgin Metalformers Corp.
Fairchild Camera & Instrument Corp.
Federal Telecommunication Laboratories
General Aniline & Film Corp.
General Communication Co.
General Electric Co.
General Telephone Corp.
Gilfillan Bros., Co.
Globe Wireless, Ltd.
Gray Manufacturing Co.
Hallamore Electronics Co.
Haller, Raymond and Brown, Inc.
Hallicrafters Co., The
Haloid Xerox Inc.
Hazeltine Electronics Division, Hazeltine Corp.
Heinemann Electric Co.
Hoffman Laboratories, Inc.
Hogan Laboratories, Inc.
William F. Hogan Associates, Inc.
Hughes Aircraft Co.
Illinois Bell Telephone Co.
Indiana Bell Telephone Co.
Indiana Steel & Wire Co.
Institute of Radio Engineers
International Business Machines
International Resistance Co.
International Telephone & Telegraph Corp.
International Telephone & Telegraph Laboratories
ITT Federal Division of International Telephone & Telegraph Corp.
Jacobsen Manufacturing Co.
Jansky & Bailey, Inc.
Jerrold Electronics Corp.
Kellogg Switchboard & Supply Co.
Kleinschmidt Laboratories, Inc.
Leich Sales Corp.
Lenkurt Electric Co.
Lewyt Manufacturing Corp.
Lockheed Aircraft Service, Inc.
Machlett Laboratories, Inc.
Magnavox Co.
Marconi's Wireless Telegraph Co. Ltd.
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Michigan Bell Telephone Co.
Montgomery Co., The
Motorola, Inc.
Mountain States Telephone & Telegraph Co.
Mullard Ltd.
Muter Co.
National Co., Inc.
Nelson Technical Enterprises, Inc.
Nems-Clarke Co., Div. of Vitro Corp. of America
New England Tel. & Tel. Co.
New Jersey Bell Telephone Co.
New York Telephone Co.
North Electric Co.
Northwestern Bell Telephone Co.
Oak Manufacturing Co.
Ohio Bell Telephone Co.
O'Keefe & Merritt Co.
Otis Elevator Co., Electronic Division
Pacific Mercury Television Mfg. Corp.
Pacific Telephone & Telegraph Co.
Packard-Bell Electronics Corp.
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Phelps Dodge Copper Products Corp.
Philco Corp.
Photographic Society of America
Plessey Co., Ltd.
Prodelin Inc.
Radiation, Inc.
Radio Corporation of America
Radio Corporation of America, Defense Electronic Products
RCA Great Britain, Ltd.
Radio Engineering Laboratories, Inc.
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Raytheon Manufacturing Co.
Red Bank Division, Bendix Aviation Corp.
Reeves Instrument Corp.
Rocke International Corp.
Saxonburg Ceramics, Inc.
Singer Manufacturing Co., The Military Products Division
Smith-Corona Marchant Inc., Research and Development Division
Society of Motion Picture & Television Engineers
SoundScriber Corp.
Southern Bell Telephone & Telegraph Co.
Southern New England Telephone Co.
Southwestern Bell Telephone Co.
Sperry Gyroscope Co., Division of Sperry Rand Corp.
Sprague Electric Co.
Stackpole Carbon Co.
Standard Telephones & Cables, Ltd.
Stanford Research Institute
Stewart-Warner Corp.
Stoddart Aircraft Radio Co.
Stromberg-Carlson Co., Division of General Dynamics Corp.
Surprenant Mfg. Co.
Sylvania Electric Products, Inc.
Technical Materiel Corp., The
Tele-Dynamics, Inc.
Telephonics Corp.
Teletype Corp.
Texas Instruments, Inc.
Times Facsimile Corp.
T.M.C. (Canada) Ltd.
Transitron Electronic Corp.
Trans-Sonics, Inc.
Triad Transformer Corp.
Tung-Sol Electric, Inc.
Union Carbide Corp.
United Shoe Machinery Corp.
United Telephone Co.
United Transformer Co.
Van Norman Industries, Inc., Electronics Division
Waterman Products Co., Inc.
Webster-Chicago Corp., Government Division
West Coast Telephone Co.
Western Electric Co., Inc.
Western Union Telegraph Co.
Westinghouse Electric Corp.
Weston Electrical Instrument Corp.
Wheelock Signals, Inc.
Wilcox Electric Co., Inc.
Willard Storage Battery Div., Electric Storage Battery Co.
Wisconsin Telephone Co.
Wollensak Optical Co.
Zenith Radio Corp.

COUNTERMEASURES and the myxine glutinosa

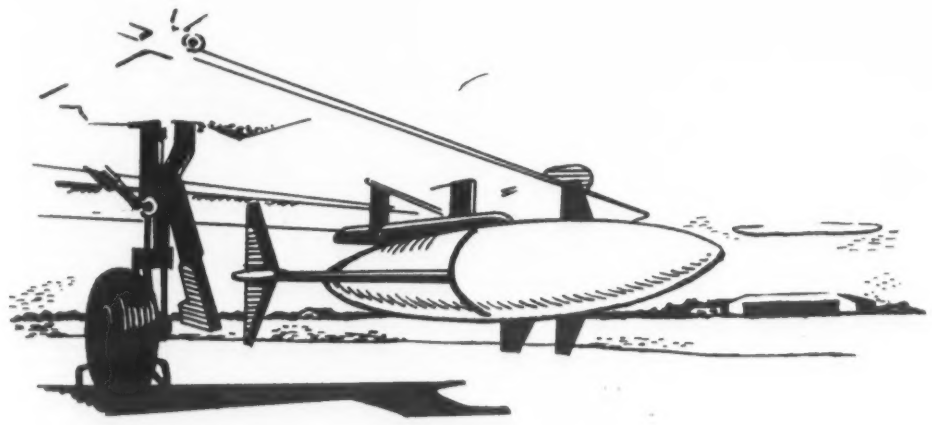


FORMIDABLE, INDEED, IS THE HORRENDOUS HAGFISH
though small in size, his capabilities are enormous...

Seventeen inches of devastating destruction are represented in the pictures above. Appearing to be no more than another small eel, this specimen can, in a matter of hours, eat his way through the skin of his victim and then proceed to devour everything except bone. Things are not always what they appear...a theme common to countermeasures .

Certain types of countermeasures under development also might be said to have hidden teeth.

A small drone, equipped with devices to make it appear as one or more bombers when viewed on radar scopes, could very well carry an atomic warhead capable of delivering a devastating blow to a secondary target. Instruments For Industry has for many years been actively engaged in the development and perfection of many types of countermeasures for the Army, Navy, Marines and Air Force. All have reaped the fruits of I.F.I.'s specialized engineering know-how.



First decoy, then destroy

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Graduate engineers with two or more years of circuit application in the fields of electronics or physics are invited to meet with Mr. John Hicks in an informal interview or send complete resume to: Dir. Personnel, IFI, 101 New South Road, Hicksville, New York.

AFCEA CHAPTERS—National Director of Chapters: Lt. Gen. James D. O'Connell, USA

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Chapter News

Atlanta

Southern Bell Telephone and Telegraph Company President Ben S. Gilmer addressed the November 18th dinner-meeting of the chapter. Mr. Gilmer, who is a National Director of the AFCEA and a Director of the Atlanta Chapter, spoke on "The Purpose of the AFCEA" and cited the Association as a powerful force for developing close cooperation between the nation's military, industrial and scientific personnel.

Mr. Gilmer paralleled the development and advancement of military communications and electronics with the early history and growth of the Armed Forces Communications and Electronics Association. He emphasized that "close cooperation, understanding and appreciation among the military, industrial and scientific personnel in these fields are more essential than ever before.

"Much of this cooperation, understanding and appreciation is developed 'on-the-job,'" he stated. "But the full benefits of close association cannot be derived from point-of-service contacts. Close friendly and personal relations should be well established on a broad local basis and on an even broader national basis at all levels. These relations must be impelled by a mutual determination to utilize the communications, electronics and photographic arts for the greatest good of our nation and the free world.

"To promote this broad, friendly, personal and professional relationship for the maximum and most efficient development of our national strength is the purpose of the Armed Forces Communications and Electronics Association."

For the benefit of SIGNAL readers, Mr. Gilmer's speech will be detailed in a subsequent issue.

Held at the Fort McPherson Officers' Club, the meeting drew a record attendance of 270 members and guests.



Atlanta—Ben S. Gilmer, Southern Bell Telephone and Telegraph President addressed chapter's November meeting. Above, Hostess Barbara Page of Southern Bell greets Mr. Gi on his arrival at Fort McPherson's Officers Club and pins on his AFCEA badge.

Augusta-Fort Gordon

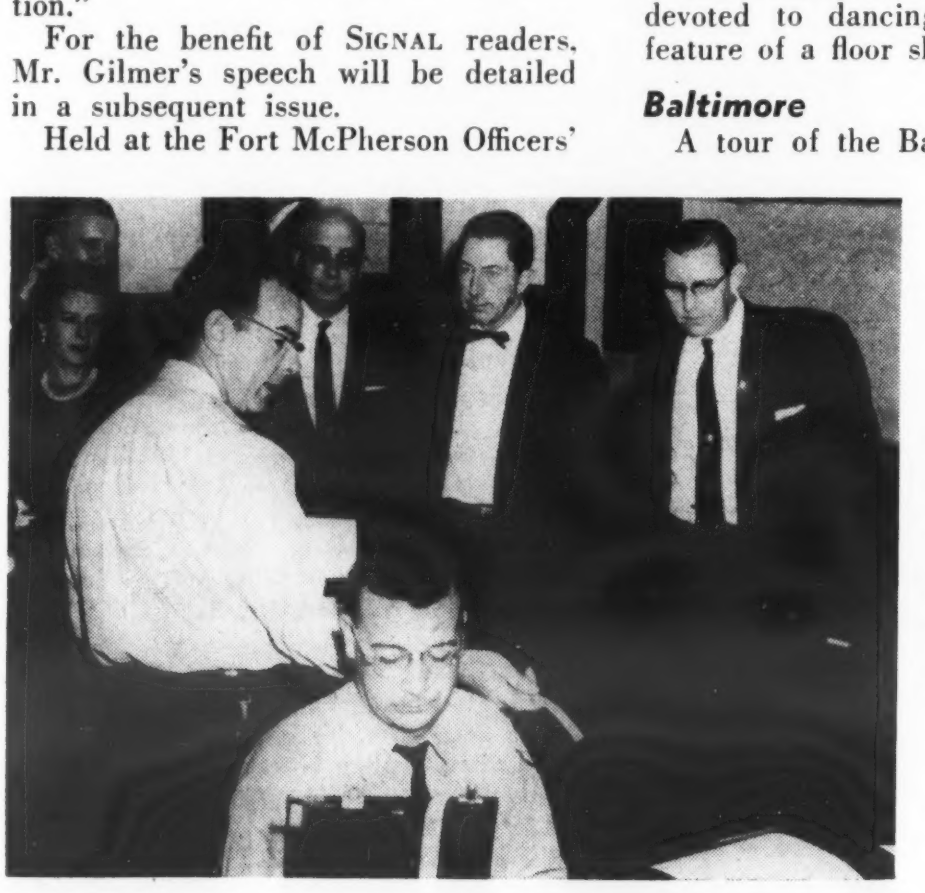
The chapter closed out the year with a Christmas party on December 18th. Held at the Fort Gordon Officer's Club, the event was termed an outstanding success by all the participants.

After dinner, President James M. Williams conducted a short business meeting to thank all the officers and committees for their help in making 1958 one of the chapter's best years. He then presented Col. Robert R. Creighton, the new president, who took over the helm and introduced the new officers.

The remainder of the evening was devoted to dancing, with the added feature of a floor show.

Baltimore

A tour of the Baltimore Police Department's communications' setup operation was the highlight of chapter's October 14th meeting.



Baltimore — The operation of the teletype system is explained to members during the chapter's tour of the Communications Department at Baltimore Police Headquarters on October 14th.

A pre-meeting dinner was held the House of Welsh. Chapter Presid Trevor Clark introduced the host the evening. Inspector William E. T lor of the Baltimore Police Departm Inspector Taylor gave a brief desc tion of the tour.

On the tour, the members obser the radio dispatcher on duty, w given a detailed description of the chanics involved in the Call Box Ro saw the operation of the teletype tem by which interstate lookout ala are broadcast and received and w informed of a new coding unit used signal an officer when he is out of car.

Dayton-Wright

Electronics for space, devices t amplify light and an electronic hi way system were some of the lat scientific developments discussed Cyril N. Hoyler, Manager of Techni Relations for RCA Laboratories, Prin ton, N. J., at a joint meeting of t AFCEA and the local section of II on December 11.

The success of the meeting, held the Dayton Biltmore Hotel and atte ed by approximately 200, was attril ted to several factors—the excelle speaker, combination of the two ganizations and ladies' night.

Using specifically built equipme Mr. Hoyler also demonstrated and d cussed the principles of a system which music is pre-set in coded for then fed into electronic circuits in a variation the mind can possibly co ceive.



Boston—Photographed at the chapter's November meeting, which hosted the senior commanders in the New England area, are, left to right: seated—AFCEA Regional Vice President Glenn D. Montgomery; Col. J e G. Gillespie, Commander, 6520th Test Group (Support), Air Force Cambridge Research Center; Rear Adm. Edwin J. Roland, Commander, First Coast Guard District; Maj. Gen. Sidney C. Wooten, Commanding General, XIII U. S. Army Corps (Reserve) and Fort Devens, and Capt. Edson H. Whitehurst, Chief of Staff, First Naval District. Chapter officers (standing)—Col. Murray D. Harris, retiring PMST, Northeastern University, director; Louis J. Dunham, Jr., vice president; Robert B. Richmond, president; Capt. Raymond B. Meader, USNR, director; William Melanson, secretary, and Fred E. Moran, director. (Col. Harris and Messrs. Meader and Moran are all past presidents of the chapter.)

Fort Monmouth

Carl Benzer, an expert on scatter communications for Radio Corporation of America, was guest speaker on that subject at the December 18th dinner-meeting of the chapter at Gibbs Hall Officers' Club. Mr. Benzer is Manager of Scatter Communications, Government Services Department, RCA Service Company.

The monthly meeting of Fort Monmouth military and civilian personnel and representatives of industry took the form of a Christmas party following the dinner and talk by Mr. Benzer.

Gulf Coast

A program on stereophonic sound was presented at the December meeting, which was ladies' night, by Chapter President Ancil Z. Arseneau, and included a talk and demonstration.

The dinner meeting was held at the White House Hotel, with many former members of the Scott-St. Louis Chapter present.

Special guest of the evening was W. O. McDowell, General Commercial Manager of Southern Bell Telephone Company in Jackson, Mississippi. Mr. McDowell was president of AFCEA's Augusta-Fort Gordon Chapter in 1953 and later served the Atlanta Chapter as chairman of its membership and program committees.



Dayton-Wright—Cyril N. Hoyler (center), Manager of Technical Relations, RCA Laboratories, is shown with AFCEA Regional Vice President Paul Clark (left) and Chapter President James J. Magill, during the December 11th meeting at which he was the principal speaker.

London

Chapter members gathered at the U.S. Air Force Base at South Ruislip, Middlesex, on November 26th, and were given a conducted tour of the communications and electronics facilities located there. Attendance was 105.

Members saw and were briefed on the following activities: AACS Major Relay Station RJDL and the Technical Control Facilities associated with the Relay Station; MATS Air Traffic Control Center and Weather Station; the Base Telephone Facilities (Manual), which are presently being converted to a new Automatic Dial Telephone Sys-



Fort Monmouth—George N. Craig, former Governor of Indiana, was featured speaker at the November meeting. Left to right are: Norman Freeman of Stromberg-Carlson and Col. Robert Haffa, U. S. Army Signal School, both vice-presidents of the chapter; Maj. Gen. George Van Deusen, USA (Ret.); Mr. Craig; Col. A. L. Burke, chapter president, and Col. Harold McD. Brown, CO, Signal Research and Development Laboratory and chapter director.



***London**—Shown during the tour of the communications-electronics facilities at the U. S. Air Force Base at South Ruislip, are, left to right: Maj. Gen. E. S. Cole, C.B.E., Director of Telecommunications, British War Office; Col. J. A. Plihal, Director of Communications-Electronics, Headquarters Third Air Force, and vice-president of the chapter; Lt. J. W. Bricker, Chief, Transceiver Section, Third Air Force, and Brigadier Sir Lionel Harris, K.B.E., T.D., Engineer-in Chief, General Post Office.*

tem, and the Electronic Data Processing System for Logistics, which was the first of its type in the United Kingdom.

After the tour, all members retired to the Officers Mess where cocktails and dinner were served. After dinner, Col. A. H. Snider, Commander, AACS-UK Region, gave a short talk covering the mission and activities of AACS in the United Kingdom.

Distinguished guest of the chapter was Maj. Gen. E. S. Cole, C.B.E., Director. Telecommunications, British War Office.

Louisiana

The chapter celebrated its tenth anniversary with a dinner-meeting on November 25th at the Naval Air Station Commissioned Officers Mess, Alvin Callender Field, Belle Chasse. On hand for the occasion was Harry B. Lackey, organizer and first president of the chapter, who is now Assistant Vice President of Southern Bell Telephone and Telegraph Company in Birmingham. Alabama.

AFCEA Regional Vice President W. Kelly Mosley, Assistant Vice President of Southern Bell in Atlanta, delivered the principal address.

After congratulating the chapter on its ten years as an active unit of the AFCEA, Mr. Mosley pointed out some of the significant events that had taken place in the world during the same decade, with emphasis on the relative advances in communications and electronics.

He described the indispensable role of electronics in modern weapons systems and stated that, "in addition to weapons systems, the ordinary local and long distance communications requirements for our military forces in the field and for continental defense dwarf anything dreamed of in World War II."

Mr. Mosley then went on to trace the evolution of the AFCEA from early Civil War days to the present. "At no time in our history has it been more important that military and civilians interested in communications, electronics and photography join together to exploit fully the military potential in these fields for the most effective development of our national strength.

"Close personal association on both the local level, as we have tonight, and



***Montgomery**—Dr. Cyril N. Hoyler of RCA Laboratories (far left) addressed the October joint meeting of the AFCEA chapter and the local section of AIEE. With him, from left to right, are: Lt. Col. Herbert Herman, Air Command and Staff College, chapter president; Frank Newton, Vice President and General Manager of Southern Bell T&T Co., Birmingham, and C. W. Weiss, District Engineer for Southern Bell in Montgomery, and chairman of the Montgomery Sub-Section of AIEE.*

the national level, as it now exists vital to the attainment of this goal. tive chapters such as yours are backbone of the Association. It co not survive or be successful with them. Our strength lies in a grow and representative membership chapter activities carefully planned achieve Association objectives."

The chapter's December 17th me ing featured a talk by Past Preside Charles Pearson, Jr. on "Penetrati the Iron Curtain." As Louisiana's Vi Chairman of the *Crusade for Freedo* Mr. Pearson had been part of a gro of sixty prominent Americans who stu ied every aspect of Radio Free Europe operations at Broadcast Headquarte in Munich, Germany.

Montgomery

The chapter held its regular monthl meeting on December 15th at the Ma well Air Force Base Officers Clu AFCEA Regional Vice President W Kelly Mosley, Assistant Vice Presider was the guest speaker.

Mr. Mosley spoke to the chapter o the background, history and organiza tion of the Armed Forces Communica tions and Electronics Association. Du ing the business session, the member approved a Constitution and By-Law for the chapter.



***New York**—Col. Ludwig Engler (right) General Sales Mgr., RCAC, retiring chapte president, congratulates Henry Bang, Asst Vice Pres., New York Telephone Co., newl elected president of the chapter.*

New York

Major General James Dreyfus, Di rector, Communications-Electronics Joint Staff, Joint Chiefs of Staff, wa the featured speaker at the dinner meeting held November 20th at th Belmont Plaza Hotel. Many in th chapter recalled their early association with General Dreyfus at both the Brook lyn Polytechnic Institute, where h studied Electrical Engineering, and a the New York Telephone Company where he started his engineering ca reer.

To the majority of the chapter mem bers, General Dreyfus' discussion wa a first look and an interesting intro duction to the Joint Staff organizatio of the Joint Chiefs of Staff. Excellen



***Northeastern University**—Army ROTC Cadet Otto Persson, left, chairman of the student chapter's electronics committee, examines articles of surplus military electronic material prior to starting work on a radio telescope with which the chapter members propose to listen to signals from the "sun and the stars." In center, Cadet Stephen P. Baranowski, a committee member, assists, while ROTC Instructor SFC Joseph A. Robichaud furnishes technical advice.*

slides showed the relationships of the directorates for Personnel (J-1), Intelligence (J-2), Operations (J-3), Logistics (J-4), Plans and Policy (J-5) and Communications-Electronics (J-6). It was significant to note a communications organization is located at the highest level of military organization where it is on a par with the classic four staff divisions. Heretofore, communications has been considered a part of the special staff and a step under the General Staff.

Discussing the aspects of "joint" and "combined" communications, General Dreyfus defined joint communications as an operation involving more than one service, usually all four—the Army, Navy, Air Force and Marines. "Combined" communications are those involving one or more of the United States services and one or more of our allies. General Dreyfus stated that a joint strategic communications system must be capable of handling message traffic. data, voice, photo, facsimile, video and weather. Such a system must be capable of rapid expansion to cover any areas where command control is needed.

The chapter's annual meeting took place on December 17th. Following the election of officers and directors, Edward J. Agnew of the Western Union Telegraph Company gave an illustrated talk on the "Air Force Plan 55 Switching System."

Mr. Agnew described this 2000-mile network which carries approximately 2½ billion words annually between more than 200 Air Force terminal points. He illustrated his talk with colored slides and showed some of the important communications equipment used in this system.

This switching system was designed and engineered with the following principal features: provision for automatic switching and also a means for manual switching; provision of compatible equipment at all points; arrangement for handling multiple address messages; plug-in equipment cabinets for quick installation. Messages are transmitted over this network at the rate of 200 words per minute and may be fed in sequence automatically from a number of sending machines. Messages are coded so that they must be routed to their destination through more than one switching point with no delay.

The following officers and directors were elected for the year 1959: president—Henry R. Bang, New York Telephone Co.; vice presidents—Edwin C. Carlson, Mutual Life Insurance Co. of N. Y.; Major Theodore N. Pope, Bell Telephone Laboratories; Lt. Col. David Talley, International Telephone and Telegraph Corp.; treasurer—Lt. Col. Richard B. Hearn, Bell Tel. Labs.; secretary—Thomas Brown, 4th, N. Y. Tel. Co.; recording secretary—Major Orvil S. Ostberg, ITT; member of executive committee—Col. Ludwig R. Engler, RCA Communications, Inc. and retiring president of the chapter; board of directors—George W. Bailey, Institute of Radio Engineers; Charles Benton, Jr., International Business Machines Corp.; Rear Adm. R. W. M. Graham, Raytheon Manufacturing Co.; Frank A. Gunther, Radio Engineering Laboratories; Lt. Col. W. L. Hallahan, Laird and Co.; J. V. L. Hogan, Hogan Laboratories; Walter A. Kirsch, Fairchild Camera and Instrument Co.; Maj. Gen. F. H. Lanahan and Maj. Gen. R. C. Maude. International Electric Corp.; Col. Julian Z. Millar, Western Union Telegraph Co.; Col. Thompson H. Mitchell. RCA Communications, Inc.; Glenn D. Montgomery, American Telephone and Telegraph Co., Long Lines Department; Milton G. Nattress, Jr., N. Y. Tel. Co.; C. Raymond Smith, Western Electric Co.; Rear Adm. Ellery W. Stone, American Cable and Radio Corp., and Jerome L. Strauss, Lewyt Corp.

Philadelphia

Chapter members and guests attended the season's first dinner-meeting on December 11th at the U.S. Army Signal Supply Agency, Philadelphia. Host for the evening was Col. E. L. Littell, Commanding Officer of the Agency.

Guest speaker Col. Loren E. Gaither, USA(Ret.), Director of Communications Engineering for Philco Corporation's Government and Industrial Division, discussed the expanded dimensions of the communications art in which he emphasized the challenge brought about by our space age. Illustrating his talk intermittently with color slides, Col. Gaither described how increased electrical transmitting power and performance in miniaturized equipment will be necessary to effect communications over vast distances within our own solar system and how stationing of space platforms will result in increased performance in our own planet aided by our relay stations.

Col. Gaither also projected a data processing system integrated with communications equipment which will necessitate a universal language for all "earth nations."

Members of the chapter also welcomed their new president, Frank Langstroth of the Philco Corporation.

Pittsburgh

The chapter met at the Buffalo Inn, South Park, on December 12th for its annual Christmas party. Seventy-seven members and guests were present.

There was an orchestra for dancing



***Philadelphia**—Chapter President Frank Langstroth of Philco Corporation introduces Col. E. L. Littell, Commanding Officer of the U. S. Army Signal Supply Agency and a vice-president of the chapter, who was host for the December 11th meeting. At right is Col. Loren E. Gaither, USA (Ret.), Director of Communications Engineering for Philco, who spoke on "The Communications Continuum."*

and a buffet supper was served at 11:00 p.m., after which door prizes and raffle prizes were distributed. The chapter reports "a good time was had by all."

Rocky Mountain

The Mountain States Telephone and Telegraph Company, AFCEA charter group member, was host to the chapter's November 21st meeting which was held at the Albany Hotel in Denver. Col. Howard S. Gee, new chapter president, presided and Clyde Blair of Mountain States gave the welcoming address on behalf of the company. Some eighty members and guests were present.

Following cocktails and dinner, a tour was conducted by Mountain States of their new toll facilities.

The holding of this meeting in Denver is a first of a series in the new Rocky Mountain Chapter policy of rotating the site of future meetings in order to focus attention on AFCEA in the Rocky Mountain area. It is planned to hold future meetings at Fort Carson, Air Force Academy, Inc.

Sacramento-San Francisco

These chapters held a joint meeting at Travis Air Force Base on November 20th. with a tour of the MATS Transport Control Center the highlight of the evening.

Maj. L. H. Miller, Director of Communications. Western Transport Air Force, was host to the visiting AFCEA members and guests. Following the dinner at the Officers Club, Major Miller gave a slide-illustrated talk describing the mission of MATS and touched on the points of interest in the tour to follow.

The tour gave the group a comprehensive view of the world-wide function of the Military Air Transport Service. Of special interest was the inspection of the C-133 turbo-prop cargo airplane.

San Diego

A Marine Corps program was featured at the chapter's monthly meeting held on December 11th. The Commissioned Officers Open Mess at the Marine Corps Recruit Depot in San Diego was the scene of the dinner-meeting.

The program consisted of a recruit training film, "The Challenge," and a presentation by the Communications-Electronics School Battalion under the direction of Major Stone.

An introductory talk was given by Maj. J. B. Soper representing the Assistant Chief of Staff, G-3.

Scott-St. Louis

The chapter passed another milestone, its seventh, and observed it with its traditional anniversary celebration at Augustine's Restaurant in Belleville. The evening's program consisted of a social hour, dinner, an illustrated-lecture and a dance.

Special messages of congratulations from AFCEA National President F. R. Furth and Executive Vice President W. B. Goulett were read to the gathering by Chapter Secretary Allan L. Eisenmayer, who also reviewed the history and growth of the Scott-St. Louis Chapter.



Scott-St. Louis—Guest speaker on November 7th was Robert M. Schwarz (center), Project Electronics Engineer, Missile Engineering Division, McDonnell Aircraft Corporation, whose topic was "Missile Guidance and Control System." At left is Chapter Secretary Allan L. Eisenmayer and at right Chapter President B. R. Robards.

Guest speaker was Harry Woodbury, demonstrations engineer, Southwestern Bell Telephone Company, St. Louis, who presented "This World of Sound."

Via the demonstration route, Mr. Woodbury conducted a tour through time and space, exploring the scientific miracles of sound reproduction and gave the group a tuneful glimpse of the past and the symphonic sounds of the future. With the aid of stereophonic and high-fidelity sound reproduction, the members heard an express train and a jet airplane pass through Augustine's Restaurant. They also "heard" a ping-pong game, and felt they were sitting in the midst of a sixty-piece orchestra. The chapter reported this was a most dynamic presentation.



South Carolina—Col. John A. McVey, USAF, Commanding Officer, 507th Communications and Control Group, Shaw AFB, is congratulated by Chapter President W. O. Kiger of Southern Bell on his election as first vice president of the chapter. The picture was taken against a background of radar equipment at Shaw AFB.

Seattle

The program at the December 10th meeting was conducted by Jack De Land of the Los Angeles Office of the Mincom Division, Minnesota Mining and Manufacturing Company, with the aid of Keith Rutherford, District Sales Representative.

Mr. De Land gave a brief review of the history and products of the 3M company. With the aid of slides, he detailed the construction and operation of the seven-channel Model C-100 data recorder-reproducer, pointing out the dependability, simplicity of adjustment and ease of maintenance which is due partly to the printed circuitry and plug-in type of construction.

Other features emphasized included: isoloop system which provides positive tape-to-head contact, isolates tight loop in recording and playback areas from common sources of flutter; all-transistor record-reproduce electronics; only twelve moving parts; dynamic breaking; low input power requirements (a complete 14-track system requires only 500 watts); extended recording time (24 minutes); instantaneous speed change; constant low rewind tension; three identical motors; all plug-in assemblies; no cooling necessary, and remote controlled operation.

A question and answer period followed the presentation.

The meeting took place at the Benjamin Franklin Hotel and was preceded by dinner and a business session.

Southern Connecticut

Guest speaker at the chapter's December 3rd meeting, held at the Wonderbar Restaurant in Bridgeport, was William

(*Continued on page 64*)



Southern California—Brig. Gen. W. A. Perry, Commander, 47th AAA Brigade, who addressed the October meeting which featured a program on "The Pentomic Army."



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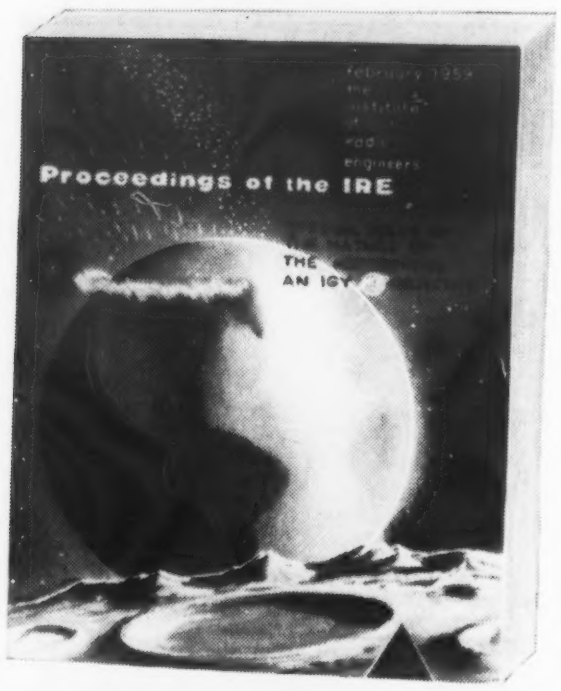
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"The Constitution and Composition of the Upper Atmosphere" by M. Nicolet, Radio and Meteorology Institute, Belgium

"The Normal F-Region of the Ionosphere" by D. F. Martyn, Radio Research Labs. CSIRO, Australia

"The Normal E-Region of the Ionosphere" by E. V. Appleton, U of Edinburgh, Scotland

"The D-Region of the Undisturbed Ionosphere" by J. J. Gibbons & A. H. Waynick, Penn State U

"The Distribution of Electrons in the Ionosphere" by J. O. Thomas, U of Cambridge, England

"Motions in the Ionosphere" by C. O. Hines, Defense Research Board, Canada

"Meteors in the Ionosphere" by L. A. Manning & V. R. Eshleman, Stanford U

"Atmospheric Whistlers" by R. A. Helliwell, Stanford U & M. G. Morgan, Dartmouth U

"Radiation and Particle Precipitation upon the Earth from Solar Flares" by L. G. B. Biermann & R. Lust, Max Planck Institute for Physics and Astrophysics, Germany

"The Very-Low-Frequency Emmissions Generated In The Earth's Atmosphere" by R. M. Gallet, National Bureau of Standards

"The F-Region During Magnetic Storms" by K. Maeda, Kyoto U & T. Sato, Shiga U, Japan

"Aurora Phenomena" by E. N. Parker, U of Chicago

"Rocket Observations of the Ionosphere" by H. Friedman, U. S. Naval Research Lab.

"Earth Satellite Observations of the Ionosphere" by W. W. Berning, Aberdeen Proving Grounds

"Exploration of the Upper Atmosphere with the help of the 3rd Soviet Sputnik" by V. I. Krassovsky, Institute for Atmospheric Physics, Moscow

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Extra copies to members, $1.25 each (only one to a member)

ITEMS OF INTEREST
From Government, Industry and the Services

Survey of the Moon

A survey of the marginal zone of the moon is nearing completion at the Naval Observatory in Washington, according to a paper delivered at the recent meeting of the American Association for the Advancement of Science. C. B. Watts, Sc.D., U.S. Naval Observatory, made the presentation.

The marginal zone of the moon contains those features that can be seen at some time outlined against the sky at the moon's limb (the edge of the apparent disk) and comprises about thirty per cent of the area that can be viewed from the earth.

Purpose of the survey is to provide a system of corrections for several classes of observations involving the moon's limb. These observations, which include determinations of the moon's place in its orbit, are reduced in accuracy by the presence of mountains and valleys on the limb.

A major portion of the survey was devoted to the establishment of an imaginary datum surface on the moon analogous to mean sea level on the earth. About 450,000 measured elevations, referred to this surface, have been plotted in the formation of the new charts. It is expected that these charts will facilitate the production of topographic charts of the remainder of the visible portion of the moon's surface. It is planned that results of the survey be published this year.

Earlier surveys of the marginal zone, less extensive than the present one, were made by F. Hayn at the University Observatory, Leipzig (1914), by Th. Weimer at the Paris Observatory (1952), and by A. A. Nefediev at the Engelhardt Observatory, Kazan, USSR (1957).

Computer Translates

An IBM 704 computer, using a dictionary with 5000 entries, has been programmed to translate French scientific articles into English at a speed of three to four words per second. Roughly half the time is consumed looking up French words in the dictionary and the other half in making the linguistic decisions needed to arrive at a reasonably good translation.

This information was presented to The American Association for the Advancement of Science by A. F. R. Brown, Ph.D., Georgetown University Research Project in Machine Translation.

The 5000-entry dictionary, which is aimed initially at articles on radiation, will not be complete for two or three months. Meanwhile, the mechanical problems have been solved using a test dictionary of six hundred entries.

The computer works on the French text in sections of approximately 1200 words. First, the words in a section are arranged alphabetically so that a single reading of the dictionary will suffice. When the dictionary has supplied 1200 "items" in exchange for the 1200 French words, the items are shuffled back into the original word order and the "real" work of translation begins.

Any item taken from the dictionary may contain one or more instructions which the computer has to carry out before the final English translation is decided on. These instructions are concerned with recognizing and translating idioms and with points of French grammar that are associated with particular words. In addition, a few general instructions are added into every sentence, regardless of what the original French was. These are for the questions that come up in almost every sentence, like where to place adjectives in English, when the corresponding French adjectives are found after the nouns they modify.

When all the instructions in a sentence have been carried out, the English words in the items, in the form and order left behind by the instructions, are sifted out, strung together and printed as the translation of the sentence.

Reports say, "The problems that have to be solved in making up a system of machine translation are something like the problems of explaining to an ancient Babylonian, in his own language, how to translate French into English—with the important restriction that you can never tell him what any English or French word actually means in Babylonian. One feature of the computer program is that other linguists could use it for other languages without having to talk to the machine in its native Babylonian. Instead, there is a fairly simple and direct code for writing dictionary entries and for telling the machine when and how to test the items in a sentence for grammatical indications, French equivalents, and other features, to alter the items if necessary and to re-arrange them if necessary before picking out the final translation."

MARS March Speakers

March speakers for the First Army Military Affiliate Radio System (MARS) Technical Net (SIGNAL, Sept., 1958, p. 50) will include:

March 4: "Frequency Measurements" by Herbert D. Tanzman, Project Engineer, Frequency Control Division, U.S. Army Signal Research and Development Laboratory, Ft. Monmouth.

March 11: "Principles of Radio Direction Finding" by Paul G. Hansel, Engineer-in-Charge, Radio Engineering Dept., Servo Corp. of America.

March 18: "Some Aspects of Grounded Grid Amplifiers" by George Grammer, Technical Director, American Radio Relay League.

March 25: "Antennas" by Michael D. Ercolino, President and Chief Engineer, Telrex, Inc.

The talks will be held on Wednesday at 9 PM EST on 4030 kc, upper sideband and can be heard by listeners within a 1000 mile radius of New York City.

Mobile Center

Development of a new highly mobile, air transportable communications center, designed to direct fast moving U.S. Army forces has been announced by the Department of the Army.

The system, which has an extremely high degree of mobility, can be set down almost anywhere by helicopters and be flown out immediately for relocation elsewhere. It can also be moved rapidly from place to place on conventional Army trucks.

Developed by the U.S. Army Signal Corps, it provides the vital nucleus for a communications network of radio, telephone, telegraph and teletypewriter combat links.



To help smother brush-fire wars, the U. S. Army's new STRAC forces practice vertical envelopment in . . .

U. S. ARMY PHOTO

exercise WHITE CLOUD

Training is rugged, realistic for the U. S. Army's STRAC —Strategic Army Corps. The recent Exercise WHITE CLOUD involved two weeks of intensive maneuvering which exemplified the mission for which STRAC was organized:

immediate response to cope with limited war anywhere in the world.

The famed 101st Airborne Division played a typical STRAC role in WHITE CLOUD, utilizing the technique of vertical envelopment to establish strategic islands or airheads deep within "enemy" territory.

Launching action from Fort Campbell, Kentucky, the 101st climaxed the Exercise by para-drop and air landing of some 5,000 troops and equipment on unfamiliar terrain in "besieged" territory at Fort Bragg, North Carolina. Here, they maneuvered against "aggressor" forces drawn from STRAC's 82nd Airborne Division under conditions simulating atomic, radiological and electronic warfare.

In keeping with STRAC's mission, General Electric provides electronic systems tailored to modern field combat requirements — air transportable, mobile over the most rugged terrain, operable under the most severe climatic conditions—systems especially adaptable to the STRAC motto, "Skilled, Tough, Ready Around the Clock."

Progress Is Our Most Important Product

GENERAL ELECTRIC

HMA 583

HEAVY MILITARY ELECTRONICS DEPARTMENT
SYRACUSE, NEW YORK

The system can be carried by helicopters to a remote destination in hours rather than days, or can be set up on otherwise inaccessible mountain tops. With its communications tentacles spread over hundreds of miles, the new system can get an urgent message through to a distant outpost even with direct lines broken or destroyed.

Speed and flexibility in communications would be vital on a battlefield where troops would have to be continuously on the move and widely dispersed to avoid annihilation by a nuclear warhead.

For quick transportation and added versatility, the center is made up of separate aluminum houses or "shelters," each fully equipped and independent. These can be hooked up quickly to fit any battle situation. Small centers for the front lines would have two or three shelters; larger headquarters would have as many as 24.

Each shelter carries its own independent supply of electricity, but can also plug into a central power source.

High priority combat messages flowing into the center from combat groups and other sources would be immediately available to the Army field commander. And the same network of communications lines carries his message with reflex speed to higher headquarters or to hard-hitting Army combat elements.

Advice on Medical Research

Establishment of a permanent committee to advise Congress and federal agencies on medical research has been called for by the head of one of the nation's large pharmaceutical firms.

Francis Boyer, Chairman of the Board of Smith Kline & French Laboratories, told the American Association for the Advancement of Science recently that the need for such a committee is "imperative" in view of the rapid expansion of federal allocations for medical research. He pointed out that in 1940, the U.S. Government spent only $3 million on medical research, but that last year the figure was $186 million, with expectations that by 1970 the sum will reach $500 million.

"It is scarcely worth laboring the point that the impact of federal expenditures upon medical research . . . has already been tremendous and inevitably will become almost 'thermonuclear," Mr. Boyer said. "There is to my mind an imperative need for an independent and, above all, a permanent group of consultants which will serve as a source of top-level advice and support to the Surgeon General, to the Secretary of Health, Education and Welfare and to Congress itself."

He said one of the committee's most important contributions would be educational — by informing the U.S. on the facts of medical research and by publicly backing the medical research programs of the government.

Mr. Boyer praised the work of a recently disbanded top-level advisory committee in the medical research field—the "Consultants on Medical Research and Education to the Secretary of the Department of Health, Education and Welfare." This committee is frequently known as the Bayne-Jones Committee after its chairman, Dr. Stanhope Bayne-Jones, former Dean of the School of Medicine at Yale. In a precedent-setting report, the Bayne-Jones group last June pointed out the scope and direction of the nation's future medical research needs. The work of this committee, he said, "is the best possible argument for continuing a similar body on a permanent basis."

The pharmaceutical industry has a vital interest in the wise allocation of federal research funds, he pointed out. With its own research expenditures, which Mr. Boyer estimated at $135 million for 1958, "it is not surprising that the pharmaceutical industry is deeply concerned that federal appropriations for medical research be expended in the wisest possible way."

"Call Director"

The Bell System is bringing out a pushbutton telephone for people in business who make or take a lot of calls. In looks and features, it is unlike any previous telephone.

The new instrument, the "call director," is a low, compact button-studded unit with hand receiver cradled at its side. It can provide interoffice communication, arrange conference calls and "add on" other extensions to incoming calls.

The call director was tested in a six-month trial among business customers in New York and introduced in January in two models—one provides up to 18 push buttons and a larger model has up to 30 push buttons.

Bell engineers say the instrument's special design makes possible fast installation and rearrangement of service, with a minimum of inconvenience to telephone users.

Names in the News

Maj. Gen. Herbert M. Jones has joined Avco Manufacturing Corporation as a consultant and will make his headquarters in the Washington office. General Jones recently retired as the Adjutant General of the Army, a post he assumed January 1, 1957. In 1950, he served as Adjutant General, Supreme Headquarters, Allied Powers, Europe. He served with distinction during World War II as Chief of Staff, IV Island Command, South Pacific Theater. Gen. Jones was subsequently Chief of Staff of the Army garrison forces at Okinawa.

Colonel Sidney S. Davis recently joined the faculty of Northeastern University as Professor of Military Science and Tactics, the Office of the Chief Signal Officer announced recently. He succeeds Colonel M. D. Harris, who retired in December after serving at the University since 1953.

Sam Norris, President and Chairman of the Board of the Nuclear Corporation of America, Inc., has been appointed as Consultant to the Director of the Electronics Division, Business and Defense Services Administration, U.S. Department of Commerce. His services will be available as required primarily on matters relating to electron tubes and nuclear-electronic apparatus.

Brig. Gen. H. F. Gregory, USAF (Ret.), has joined Midwestern Instruments of Tulsa, Oklahoma, as Vice President, Assistant to the President. Prior to his retirement, he served as Commander, Air Force Office of Scientific Research, a post he assumed in 1956.

Maj. Gen. R. C. Maude, USAF (Ret.), has joined International Electric Corporation, an associate of ITT. Gen. Maude was previously associated with the Du Mont Laboratories.

Lt. Col. David Talley has transferred from the Active to the Retired Reserve of the U.S. Army Signal Corps after a 32-year career with the Corps. Col. Talley is director of radio engineering for the telecommunications operating group of International Telephone and Telegraph Corporation.

R. N. Nicola has been named President of the Newton Company. He succeeds Gerard H. Morrissey, who became Chairman of the Board. Mr. Nicola joined the company in 1954.

Louis P. Clark has joined Radiation, Inc. He was formerly Executive Vice President of Teledynamics, Inc., an organization which he helped found.



RESERVE YOUR EXHIBIT SPACE FOR THE FOURTH LARGEST ELECTRONICS SHOW



For 12 years the AFCEA has reflected the major technological advances and breakthroughs in communications and electronics through its annual convention. The exhibition, largest in Washington and 4th largest in the country, provides a meeting ground for industry and the military services—an opportunity for the civilian-military teams and their representatives to benefit from each other's achievements. Our constantly expanding knowledge and progress in space exploration has inspired the theme of this year's convention—Communications and Electronics, Hallmarks of Outer Space—*to be held at the Sheraton-Park Hotel, Washington, D. C., on June 3, 4, 5, 1959. With 80% of the exhibit space already sold, it is essential to reserve your space now to guarantee your place at this important show. Wire William C. Copp & Associates, National Exhibits Manager, 72 West 45th Street, New York 36, N. Y.*

COMMUNICATIONS, ELECTRONICS & PHOTOGRAPHY — — HALLMARKS OF OUTER SPACE

JUNE 3, 4 & 5 **THIRTEENTH AFCEA CONVENTION**

Items of Interest (Cont.)

Veterans Major Asset

Experts who predicted the 15.3 million veterans of World War II would become an economic liability in peacetime were wrong according to a recent *Time* Magazine survey.

The reports indicate that veterans have settled into civilian life with a sense of order and responsibility that has in many ways changed the course of U.S. life and produced a major national asset.

The homecoming, says *Time*, was fraught with misgivings; Economist Sumner Slichter wrote that "in the opinion of many persons" millions (perhaps 8,000,000) would find no jobs in an economy which, like the service veterans, had to reconvert to peacetime production. Afraid that subsidies would lure idle vets to campus, University of Chicago's Robert M. Hutchins warned that vets would breed "educational hobo jungles."

Despite the dire outlook, the magazine finds World War II veterans, followed by those of Korea, have gone back into civilian life "with hardly a ripple." Many brought back technical and supervisory proficiency that encouraged and staffed the postwar technological revolution.

The survey attributed the smooth transition in large part to various aids provided by the government. The G.I. Bill of Rights and related laws offered what one vet calls a "bonus in advance," the most lavish assistance program in history (total Veterans Administration spending since 1946: $72 billion). U.S. Employment Service set up a nationwide hunt for jobs. The VA guaranteed $50 billion worth of low-interest loans to help buy 5,700,000 homes, 73,000 farms, 237,000 small businesses.

Aided by financing and free education, veterans quickly overtook non-vets their own age in earning power (from 15% behind in 1946 to 19.5% ahead in 1956). G.I. education boosted incomes enough, reckons the VA, to pay its $14.5 billion cost in extra income taxes by 1970.

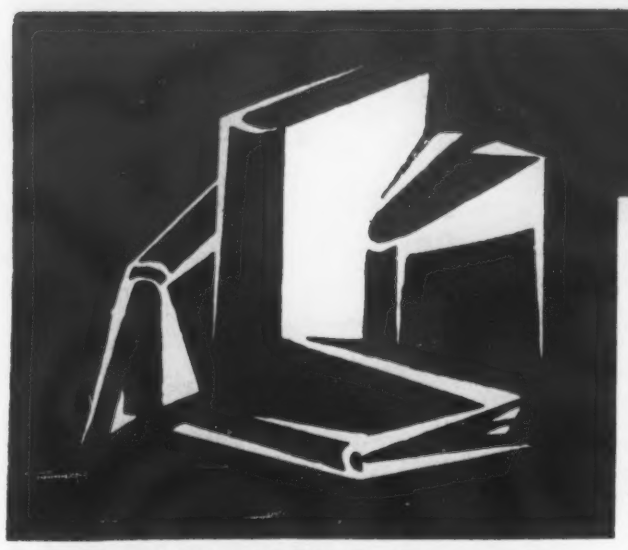
Portable TACAN Beacon Simulator

A portable test instrument designed to check performance of airborne TACAN and DMET air navigation equipments has been introduced by the Hoffman Laboratories Division, Hoffman Electronics Corporation.

Designated the HLI-119, the instrument simulates the operation of the TACAN ground beacon by generating a standard TACAN signal on any two of the 126 TACAN channels. It makes possible checks of range and bearing operation, coding and decoding, and operating frequency, and enables the user to measure peak power and receiver sensitivity of the airborne equipment.

TACAN and DMET airborne equipments operate with TACAN ground stations, which are being installed by the military services and VORTAC ground stations, which are being installed by the Civil Aeronautics Administration. The two systems provide the standard short-range (200-mile) flight control on U.S. airways, giving the pilot continuous information on his direction and distance from a ground station.

Measuring 8¾ x 12 x 18½ inches and weighing approximately 35 pounds, the HLI-119 is suitable for use wherever TACAN or DMET equipment is used. It can function as an accurate signal source in a laboratory or as a "go-no-go" checkout device on the flight line.



Books

NAUTILUS 90 NORTH, by Commander William R. Anderson, U.S.N. with Clay Blair Jr. The World Publishing Company, New York. 239 pages, $3.95.

Another human footnote has been added to history by Cmdr. Anderson's account of the Nautilus' "short-cut" from the Pacific to the Atlantic via the North Pole. Many months of detailed and top secret preparation were finally ended by an announcement over the loud speaker, and another scientific breakthrough was underway.

The subpolar voyage of less than three months and 2000 miles is dramatically related in *Nautilus 90 North* —the history-making code message with which Cmdr. Anderson revealed to the world the success of the first such polar crossing. Life aboard the submarine, the human and humerous incidents of the crew, the suspense of top secret orders and the unequalled excitement of the first polar probe are recreated in vivid detail.

The drama and tension of preparations, mishaps and repairs, omens good and bad, that took place before the announcement of destination North Pole was made are revealed with enthusiasm. And the author relates with the immediacy of his on-the-scene participation in each moment, the narrow escapes, the special problems of navigation that had to be overcome, how special instruments were installed in secrecy, the "cover plan" that kept the whole navy mum, and finally the incredible adventure itself.

PEARL HARBOR TO GUADALCANAL: History of U.S. Marine Corps Operations in Warld War II, Vol. I, by Lt. Col. Frank O. Hough, USMCR, Maj. Verle E. Ludwig, USMC and Henry I. Shaw Jr. Historical Branch G-3 Division, Headquarters, USMC. 411 pages $5.00.

The need for an analytical and interpretive official history of Marine Corps operations useful to civilian and military students and scholars as well as to the general public was recognized soon after World War II. Representing a decade of preliminary studies and extensive research, *Pearl Harbor to Guadalcanal*, the first volume of a projected five-volume series is one result of this recognition.

In this book, the Wake Island, Midway and Guadalcanal actions have been reassessed in the light of the comment and criticism they were originally written to evoke. Extensive use has been made of Japanese material that has become recently available. The story of the development of amphibious doctrine, , techniques and equipment is related in context with the narrative of Marine Corps operations in the short-of-war period.

Included in the interesting analysis and reanalysis are a narrative bibliography, a summation of casualties, a separate map section, and numerous photographs.

WATCH YOUR LANGUAGE, by Theodore M. Bernstein, Channel Press. Great Neck, New York. 268 pages, $3.95.

Man has sent satellites into orbit around the earth, he has transmitted radio signals through outer space, he has invented machines that "think" billions of times faster and more accurately than man himself, but the relatively simple problems of communication by language that have existed since human life began, he still frequently fails to solve and even ignores. While a scientist may spend years perfecting one formula, a writer who must communicate with millions of people through the medium of the daily press often neglects to use proper grammar, to write clearly and concisely and to attract the attention of the reader who depends on him for news.

In *Watch Your Language*, Mr. Bernstein offers a writer's guide to economical, accurate and vivid writing that is both instructive and entertaining. In a compilation of "winners and sinners" of style, drawn chiefly from *The New York Times*, he points out the frequent occurrences of misused and wasted words and offensive colloquialisms, the importance of making a news story interesting yet accurate, and provides "helpful hints for hatchet men" (copy editors) and headline writers.

The book consists principally of examples accompanied by pertinent comments and exposition which make the reader wonder how he has existed for so long committing inadvertently such obvious errors.

ROCKET TO THE MOON, by Erik Bergaust and Seabrook Hull. Van Nostrand, Princeton, N. J. 270 pages, $5.95

October 4, 1957. How many times has this date been seen in the newspapers or heard on the radio? Since the launching of Sputnik I, public interest in space has been greatly generated and yesterday's remote possibilities are now discussed as tomorrow's probabilities.

The authors of *Rocket To The Moon* take a realistic and provocative view of the immediate problems of the space program of the United States with particular attention given to conquest of the moon. Mr. Bergaust and Mr. Hull present for the layman a comprehensive analysis of the technical, military and political aspects of this venture. Included in this are a brief semi-factual account of an actual manned lunar voyage, a detailed discussion of the topography and atmosphere of the moon and the broad significance of man's conquest of his only natural satellite.

Convinced of the importance and feasibility of reaching the moon, the authors are openly critical of this country's space policies. In discussing "our present potential," however, they strongly imply that the recent recognition of the importance of space exploration will result in theory rapidly becoming reality.

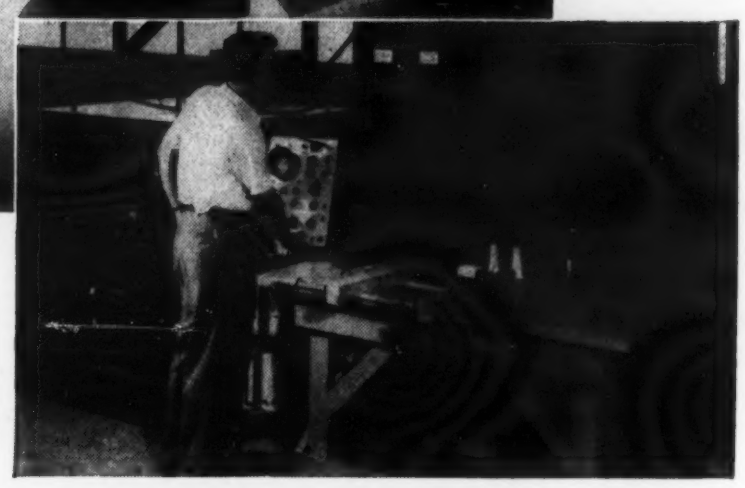
THE ATOM AND THE ENERGY REVOLUTION, by Norman Lansdell. Philosophical Library, Inc., New York. 200 pages, $6.00

The new revolution in the methods of energy production cannot help but have profound and far-reaching effects on the whole of human life and society. The development of atomic power is increasingly influencing the balance of world trade and the relation of industry to the state, while the physical aspects of radiation hazards and fall-out may seriously affect national sovereignty.

The Atom and the Energy Revolution is a general analysis of atomic energy in its discovery and uses for the intelligent reader who wishes to grasp the social and political implications of the new scientific breakthrough—for the businessman who must adapt himself to the new economy—and for the specialist in any related field of inquiry.

The chief topics included are: the atom, it's energy and methods of releasing it; material sources of atomic energy; its exploitation by separate countries and by international bodies and its impact upon the universe.





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Bulletin SC-107 A . . . this newly-reprinted 52-page bulletin contains design information on Arnold Tape Cores wound from Silectron (grain-oriented silicon steel). It includes data on cut C and E cores, and uncut toroids and rectangular shapes. Sizes range from a fraction of an ounce to more than a hundred pounds, in standard tape thicknesses of 1, 2, 4 and 12 mils.

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NEW PRODUCTS FROM INDUSTRY

Eidophor: A Film-size Image-Producing TV Projector

Eidophor, a new television "control layer" projector that produces a bright and sharp 12 x 16 foot color picture and a black and white image up to 24 x 32 feet has been unveiled by CIBA Pharmaceutical Products Inc. of Summit, New Jersey. The projector is 65 x 25 x 48 inches and weighs under 800 pounds.

The control layer projection system is principally a relay system in which electrical impulses from the camera control an electron beam which bombards the surface of a film of oil on a concave mirror. Light passing through the resulting "wrinkles" in the oil film is projected through a special grating onto the screen. The system uses an electro-optical control of the light beam from an outside source to produce the picture.

With Eidophor it is possible to achieve a contrast equivalent to that obtained with good film projection. Eidophor uses the field sequential system of color reproduction. Utilizing color wheels in the camera and in the projector, the sequential system adds considerably to the accuracy of the color image produced.

Projecting a large, theatre-sized color picture, and using its own power unit which is carried on a prime mover, Eidophor represents a breakthrough whose future will evince considerable interest in presenting telecasts to large professional audiences in hospitals, universities and at scientific meetings as a public service.

New Fixed Loop Antenna

An antenna that it is believed will improve the performance of all Aeronautical Radio Inc. (ARINC)-approved Automatic Direction Finder (ADF) systems, has been developed by Bendix Radio Division of Bendix Aviation Corporation of Baltimore. The antenna, scheduled for production early this spring, contains two basic units: the LPA-71 Fixed Loop Antenna and the GMA-71 (A or B) Goniometer.

The antenna is less than 1" thick, which enables it to be mounted outside the skin of the aircraft without the need for fairings or cavities and with drag reduced to a minimum. Both versions of the goniometer are in standard 3" instrument cases. The GMA 71-B, which was designed specifically for business aircraft or other light plane application, has a pointer for ADF indication.

One of the principal features of the fixed loop antenna is the fact that the loop installation, itself, contains no moving parts. With all mechanical components mounted in the goniometer, away from the relatively severe environment of the skin of the aircraft, antenna maintenance and accessibility are no longer a consideration, as in effect, the loop becomes part of the airframe.

The antenna and the goniometer weigh 2.9 pounds and 1.9 pounds respectively.

New Infrared System Enables Searcher to Scan Unobserved

A device that permits a searcher to operate unobserved has been invented by the president of Haller, Raymond & Brown, Inc. of State College, Pa., the research and development arm of The Singer Manufacturing Company's Military Products Division.

The system employs infrared radiation to make the original detection and determine the direction of the objects discovered. By using this passive approach as a substitute to continuous radar operation, the observer conceals his presence during this phase of the search. Once the object is discovered and its direction determined, a very short series of radar pulses obtains the range. Thus, electronic countermeasures of an enemy are given minimum opportunity to detect the observer because of the slight duration of radar operation.

Both IR and radar images appear on the same screen, and should it be desirable to obtain detailed resolution, an IR image scanner could be integrated into the system for this purpose.

Tiny, Ultra-Fast Semiconductor Switch

As a result of intensive research to find ways of increasing substantially the speed of special computers, scientists at Sperry Gyroscope Co. and Sperry Semiconductor Division of Sperry Rand Corporation have introduced a semiconductor device which they claim can switch current on or off faster than .1 millimicrosecond. Applied now in experimental equipment, the actual speed of the device can only be calculated at .05 millimicroseconds and 100 times faster than any previous semiconductor switches, as it exceeds the limit of the fastest measuring apparatus on which it was tested.

Working element of the new switch is a tiny semiconductor alloy junction formed by the fusion of a speck of aluminum to a tiny piece of silicon. The diameter of the layer formed at the junction is .002-inch and 4 millionths of-an-inch thick.

Operation of the device is based on an atomic mechanism in the junction layer which blocks the flow of current until it is actuated instantaneously by slight voltage changes.

An avalanche effect is thus created by the acceleration of electrons which knock other electrons out of their atomic shells.

According to officials of the company, the new switching device will make it possible for "ultra-fast computers . . . to process vast quantities of information at such fantastic rates that a problem conceivably requiring one year of continuous operation in present computers could be completed in less than three days."

Auxiliary Memory Aids Computer Time

A new core storage buffer, that permits full utilization of computer time in data processing involving slower functioning external equipment, has been introduced by Telemeter Magnetics, Inc. of Los Angeles. The new buffer, Model 720-BA7, operates at a rate of 100,000 characters per second, accepts any size block of data up to 720 characters of 6, 7 or 8 binary bits each, and features the inclusion of marker pulses to indicate when a block of data has been loaded, permitting the unit to load more than one block of data at a time.

Adaptable to printers, paper tape, magnetic tape and punched card units, the buffer operates on a self-contained power supply. It provides parallel loading and unloading of all bits of each character, sequential loading and unloading of characters and remote manual or electronic clearing. It also features optional input register, output register, align register and parity check.

progress report on Aeronutronic



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New Products (Cont.)

Transistorized "Handie Talkie" and 2-Way Radio From Motorola

A mobile two-way radio and a pocket sized transmitter and receiver combination are two new developments from Motorola, Inc. They were demonstrated at a special communications symposium sponsored by the company in Washington, D. C., recently.

According to the firm, the principal features of the two-way mobile radio called MOTRAC (Motorola Transistorized Advanced Communications), are its increased reliability and low power drain characteristics. MOTRAC is the first two-way radio of its kind with a fully transistorized receiver and is designed to utilize all the advantages of the transistor—reliability, light weight, compactness, reduced maintenance and operating costs.

Similar advantages apply to the "Handie Talkie" pocket transmitter and receiver. The unit measures only 5¾ x 2½ x 1⅛ inches and can be worn securely on a belt or in a pocket unobserved.

The audio output is 100 milliwatts and provides reliable voice communications even in noisy locations. The high power output of the transmitter and crystal controlled frequency aid in maximizing the communications range. Chassis sensitivity of the receiver is .5 microvolt in the 25-54 mc band and 1.0 microvolt in the 144-174 mc band. The "Handie Talkie" is designed to withstand the rough treatment inherent in portable operation. Transistorization, reliable printed circuitry, and shock mounting in a high-impact plastic housing integrated with improved electrical and mechanical design render it highly useful in increasing the communications efficiency of numerous commercial and militarv organizations. This is truly a "Dick Tracy" outfit.

Fully Transistorized Data Processing System

Production of a completely transistorized general-purpose electronic data processing system has been started by Radio Corporation of America. The RCA 501 includes the computer and auxiliary input and output equipment—all transistorized, the company reported. The unit also features a magnetic tape "memory" that records messages on variable tape lengths, a "reading head" which reads tape moving in either direction and a "time-sharing" system which permits the system to perform multiple operations simultaneously.

According to RCA's president, the system "bridges the gap between electro-mechanical accounting machines and giant electronic computers" and "brings full-scale data processing within reach of the average company." He also said that the system "permits a bank, a business office, or a factory to inaugurate data processing on a moderate scale and expand the operation in orderly, manageable stages without discarding original equipment or changing programming approach."

Custom Built Transit Cases

Protective packing and shipping cases that will protect against shock. impact, crushing, humidity, water damage, fungus and theft are being built by White Aircraft Corporation of Three Rivers, Mass. Designed primarily for the electronic or optical manufacturer who supplies delicate. intricate, expensive or sensitive instruments or components, the cases can be stacked, carried, floated, fire proofed and tamper proofed. Their basic construction is of sheet or sandwich aluminum.

Transistorized Tranceiver

Developed by Rixon Electronics, Silver Spring, Maryland, a completely new transistorized tranceiver is capable of transmitting digital data over voice communications circuits at speeds up to 2500 baud (bits/second). Called the Sebit-25, which is a condensed form of *Se*rial *B*inary *I*nformation *T*ransmission, the unit is a simple AM system that uses vestigial sideband transmission and synchronous operation.

Operating on a power consumption of less than 50 watts, the tranceiver includes time delay and amplitude distortion compensating circuits, and field tests have indicated that it can be operated successfully over wire lines several thousand miles long. The Sebit-25 has a wide variety of uses; among them are transmission of high speed data between business machines or computers, high speed facsimile information, time division multiplex information and sequential telemetering data.

Voiceplex System

A new Voiceplex system (Model VP-55-1A) has been developed by Kahn Research Laboratories, Inc. of Freeport, L. I. Designed for use on low quality land lines, carrier telephone circuits and radio links, the system, it is said, will double the present number of voice channels used in railroad communications.

A novel time division multiplex technique for transmitting and sequentially sampling the two separate channels, Voiceplex samples at a very slow rate. It permits the transmission of two voice messages in the same frequency spectrum normally occupied by one. In conventional multiplex systems the sampling rate is either equal to or greater than the highest frequency being transmitted which results in a bandwidth requirement of from six to ten times that of a single-channel system. Thus, the Voiceplex technique enables the use of the same bandwidth as a single telephone signal without obsolescence of existing equipment or increasing spectrum requirements.

New Literature

Advanced Home-Study Course In Nuclear Energy Industry

The need for more specialized knowledge than ever before in all phases and levels of scientific industries is now a well-recognized problem. To help meet the demand for trained personnel in these fields CREI Atomics is now offering a home-study course in nuclear engineering technology which the Institute believes is the first advanced home-study program in this field. CREI Atomics, recently established as a division of the Capitol Radio Engineering Institute, maintains as its objective a means to provide industry, the government and the military services with engineering and technical personnel who have a sound background in, and understanding of subjects related to nuclear energy.

In a pamphlet entitled *Your Future In The New World Of Nuclear Power*, CREI Atomics gives a complete outline of its curriculum and information about the preparation, purpose and approach of the program. Also presented are a background of the growth of the nuclear industry and the important nuclear energy applications.

CREI is also offering a home-study course in automation and industrial electronics engineering technology. Special emphasis will be given to the theory, functioning and applications of servomechanisms and computers. Noteworthy are the lessons on machine control, instrumentation, data-processing and telemetry.

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Chapter News

(*Continued from page 52*)

C. Copp, AFCEA's National advertising representative and exhibits manager.

Mr. Copp gave the members an overall picture of Association objectives, with emphasis on membership, advertising in SIGNAL, and exhibits at its annual convention.

Switzerland

The chapter held a dinner meeting at Hotel des Bergues, Geneva, on November 24th.

After a short business session conducted by the president, Capt. Gerald C. Gross (USNR), the evening was devoted to the showing of a film on the use of radio communications in many phases of public service and industry, proving the vast and often unrealized role which these communications now play in making a modern, industrial world possible.

Subsequently, a demonstration of the latest development in phonograph records was given—i.e. stereophonic recording. The striking improvement over previous systems was so evident that, due to the interest of the participants, the evening continued long beyond the hour anticipated.

The President was particularly happy to be able to welcome on this occasion, some 50 delegates to the International Telegraph and Telephone Conference in Geneva, representing some 35 countries, who gave a special international flavor to the meeting. The total attendance was over 100.

Washington

The chapter's December 11th luncheon-meeting was reported in the *Evening Star* as follows:

"Don't worry if you're squeamish about heights, because 'man's natural environment is on the ground.'

"That's the word from the Navy's top-notch balloonists, who established a new, unofficial world altitude record of 86,000 feet over South Dakota last October. They are Dr. John D. Strong, professor of astrophysics at Johns Hopkins University, and Comdr. Malcolm D. Ross of the Office of Naval Research.

"Comdr. L. P. Pressler of the research office, who has been closely identified with the program, first advanced the idea that such uneasiness is due to 'perspective' and that human beings just don't like to be off the ground.

"The two balloonists who set the record readily agree.

"Why then, would a man want to go up in the air in an attempt to observe space far above the earth's surfaces?

" 'You have to be either a believer or a crusader,' replied Comdr. Ross.

"The balloonists planned to explore the atmosphere around Mars, and another effort will be made next spring.

"They appeared at a meeting of the Washington chapter of the Armed Forces Communications and Electronics Association at the Willard Hotel.

"Their Gondola is called a 'space laboratory' and is used for terrestrial measurements, the amount of water vapor in the air at altitudes of 80,000 to 100,000 feet.

"More than several thousand pounds of telescopes and other instruments are in the gondola. The telescopes are electronically operated and the two in the gondola weigh about 900 pounds each.

"Comdr. Ross explained at the luncheon that at such elevations more than 75 percent of the earth's atmosphere is below them. From this vantage point, the balloonists will have a clear view of other planets unhindered by refraction and other interfering effects of the earth.

"The commander described the balloon as an 'ideal platform for observation in space.'

" 'We can measure dust to find out how we can be affected,' he said.

"Comdr. Pressler said that the Navy presently is working out an agreement with a new National Aeronautics and Space Administration on the use of balloon terrestrial observations."

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RADIO CORPORATION of AMERICA

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DEFENSE ELECTRONIC PRODUCTS

CAMDEN, N. J.

How Radar Got Its N

Before Columbus, radar had no name. It was calle
with no name."

Aboard the Santa Maria, *however, "the thing wit*
behaved in a most startling manner. No matter wh
antenna was pointed, the scope, like a rear view mir
only where the ship had been — not where it was g
phenomenon was most unnerving to all hands, sinc
tated the ship's going backwards much of the time . . .



*

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Its Name

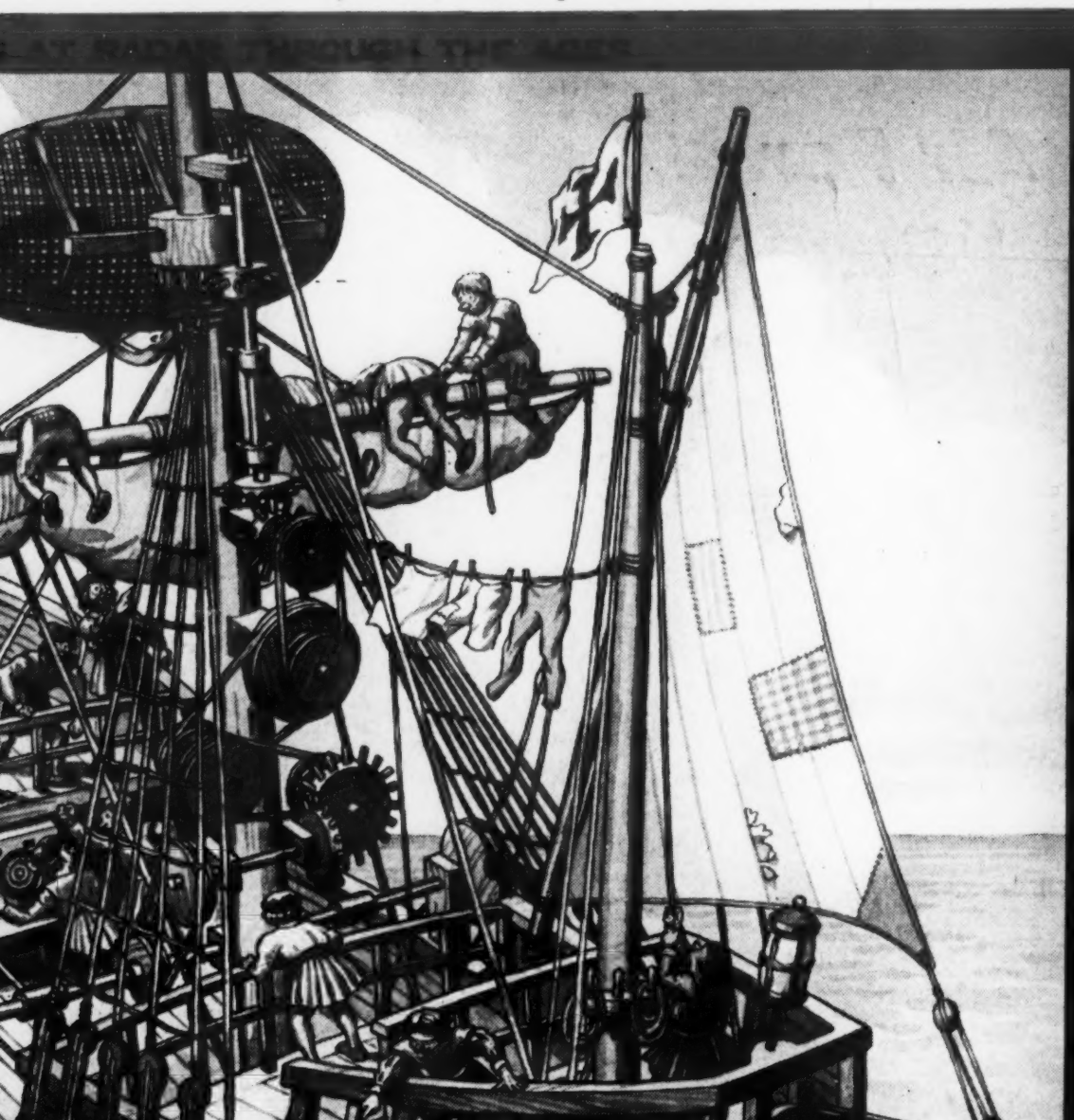
t was called "the thing

e thing with no name"
matter which way the
r view mirror, showed
re it was going. This
ands, since it necessi-
he time . . . a condition

that gave rise, among other things, to a peculiar kind of mariner's nausea that came to be known as "throwing down".

So it is hardly surprising that on the morning of October 12, 1492, Columbus found himself on the rocks at San Salvador. Once on land, the crew re-christened the thing with no name and called it "radar" — the thing that looks the same way coming or going.

A few days later, the radar operator discovered the trouble: the tubes had been inserted upside down. Columbus was so grateful he bestowed upon him the Order of Camob . . . which, of course is Bomac spelled backwards.



Bomac

tubes; shutters;
ons; duplexers;
surge protectors.

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Communications

March 1959


STOP
DOWN
ON
ZS